United States Department of the Interior
Bureau of Land Management

Lewistown District Office
Great Falls Resource Area

March 1990

DRAFT
Blackleaf Environmental Impact Statement

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

BLM-MT-ES-90-003-4111

United States Department of the Interior

TAKE PRIDE IN AMERICA

BUREAU OF LAND MANAGEMENT
GREAT FALLS RESOURCE AREA OFFICE
812 14TH STREET NORTH
P.O. DRAWER 2865
GREAT FALLS, MONTANA 59403-2865

IN REPLY TO:

Dear Reader:

This draft environmental impact statement (DEIS) on the Blackleaf Field Development project is provided for your review and comment. This DEIS assesses the impacts of the field development in the Blackleaf Unit and the immediate surrounding area. It has been developed as an interagency effort under the lead of the United States Department of Interior, Bureau of Land Management and with the United States Department of Agriculture, Forest Service, and Montana Department of Fish, Wildlife, and Parks as cooperating agencies.

We welcome your comments on this DEIS. Those comments addressing the adequacy of the scope of this DEIS or the impact analysis will be responded to in the final EIS. Specific comments are the most useful; these include suggestions for alternative data sources or impact analysis methodologies. All comments will be considered in the decision making process.

We would appreciate your comments on the DEIS by July 13, 1990. Questions or comments should be directed to Doug Burger, Area Manager, Great Falls Resource Area, Bureau of Land Management, Box 2865, Great Falls, Montana 59403, (406) 727-0503.

Open houses have been scheduled to allow individuals the opportunity to comment on the DEIS or to discuss the document with resource professionals involved in its preparation. The open houses will be held at the following locations:

Date	City	Time	Location
5/7/90	Great Falls	3 - 9 p.m.	Montana Department of Fish, Wildlife, and Parks, 4600 Giant Springs Road
5/8/90	Choteau	3 - 9 p.m.	Public Library, Choteau
5/9/90	East Glacier	3 - 9 p.m.	Community Center, Highway 2, East Glacier
5/16/90	Missoula	3 - 9 p.m.	BLM Office, 3255 Fort Missoula Road
5/17/90	Helena	3 - 9 p.m.	Park Plaza Hotel, 22 North Last Chance Gulch (Rimini Room)

Please keep this copy of the DEIS, as an abbreviated final EIS may be issued in accordance with the Council on Environment Quality (CEQ) regulations. A copy of the final EIS will be sent to all those on the DEIS mailing list and anyone requesting a copy.

In accordance with the CEQ regulations, this draft incorporates a number of other documents by reference, i.e., Rocky Mountain Front Interagency Guidelines. These supporting documents can be obtained from the address shown above.

Sincerely,

Douglas J. Burger

Douglas J. Burger
Area Manager

United States Department of the Interior
Bureau of Land Management
Lewistown District Office
Lewistown Montana

DRAFT

BLACKLEAF

Environmental Impact Statement

This draft environmental impact statement (EIS) discusses management options for oil and gas development on 58,503 surface acres and 40,327 federal subsurface acres in northwest Montana. The EIS area contains a mix of private land and lands managed by the Bureau of Land Management, the U.S. Forest Service and the State of Montana, which are all cooperating agencies in this project.

This draft analyzes the environmental and social consequences of four management alternatives (including the preferred alternative) through the life of the Blackleaf Production Unit and its surrounding area (approximately 25 years at current production rates).

Alternative 1 would limit oil and gas development to the existing wells and the related equipment to bring them into production. Alternative 2 would allow industry to develop the known energy resources within the EIS area with minimal restrictions. Alternative 3 would favor resource protection while allowing some development to occur. Alternative 4, the preferred alternative, represents a mix of resource considerations and energy resource production.

For further information,

contact: Doug Berger, Area Manager
Great Falls Resource Area
P.O. Drawer 2865
Great Falls, Mt 59403
(406)727-0503

or contact: Dale Gorman, Forest Suprevisor
Lewis and Clark Forest
Great Falls, Montana 59403
(406)791-770

SUMMARY

This draft environmental impact statement (EIS) analyzes the impacts of full field oil and gas development along the Rocky Mountain Front in Teton County, Montana. The EIS includes three alternative scenarios that focus on various levels (number of wells) of development and a No Action alternative.

The Bureau of Land Management (BLM) is the lead agency since the Bureau is responsible for permitting oil and gas exploration and development activities on federal mineral estate. The U.S. Forest Service (USFS) and Montana Department of Fish, Wildlife and Parks (MDFWP) are cooperating agencies in this effort because of the significant surface acres and important resources they manage within the EIS area.

Because of the rights and expectations of oil and gas lease holders; the nature of oil and gas exploration and development; public concerns; the occupied threatened and endangered species habitat; the many resource values present in the region; recommendations from other agencies; and because BLM policy calls for a field development analysis after the second producing well has been developed, this draft EIS was prepared.

The BLM and USFS held a series of public meetings in local communities to help define the major issues and concerns in the EIS area. Impacts on wildlife (including threatened and endangered species), scenic quality, the adjacent Bob Marshall Wilderness Area, local economy, area landowners, health and safety of area residents, tourism and recreation, and the cumulative effects of oil and gas development were all identified as concerns.

The intent of this EIS is not to simply approve or deny one resource use over another. The purpose is to provide a full discussion of any significant environmental impacts and cumulative effects that may result from full field development of this area. This EIS also explores ways to avoid, minimize or otherwise mitigate adverse impacts to the resources present in the area.

Alternative 1: No Action

In Alternative 1, the two producing gas wells (1-5 and 1-8) would remain active; however, the storage facilities would be removed and the gas piped to a central gas processing facility located on private surface over private minerals. Each of these two sites would be partially rehabilitated; the water disposal pits may be filled in and the locations reseeded with native vegetation.

The two existing gas wells capable of production but shut-in because they lack pipelines (1-13 and 1-19) would be brought on line via two short pipelines totaling 5.2 miles (4.1 miles of which would not be adjacent to the access road). The only facilities located at these wellsites (as well as the 1-5, 1-8) would be the wellhead contained inside a small shack and the separation and dehydration equipment.

All condensate would be stored at the central gas facility and all wells would be remotely monitored via computer from this facility. The natural gas would be piped east to tie in with a Montana Power Pipeline.

Any water produced from these sites would be disposed of by one of the following methods:

1. If the volume of produced water is small enough (less than 5 barrels/day), it could be disposed of on location in a fenced, lined surface pit.

2. The water could be stored on location in a large holding tank, requiring periodic removal by vehicle.

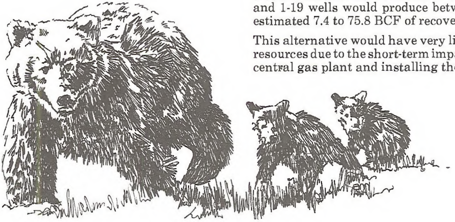
3. The water could be piped to a central facility where it would be readied for injection into the 1-16 injection well. In this alternative, as well as Alternatives 3 & 4, this central facility would be the gas processing facility. Under Alternative 2, the water would be readied for reinjection at the 1-8 wellsite.

No other development activity would be allowed under this alternative and future Applications for Permit to Drill (APD) in the EIS area would be rejected.

Alternative 1 Consequences

The oil and gas industry would be most impacted by this alternative since only 2 of the 25 federal leases in the EIS area would be developed. The reservoir produced by the 1-5 and 1-8 wells would produce between 9.4 and 18.5 billion cubic feet (BCF) of the estimated 10.4 to 29.8 BCF of recoverable reserves. The reservoir to be produced by the 1-13 and 1-19 wells would produce between 4.3 and 8.5 of the estimated 7.4 to 75.8 BCF of recoverable reserves.

This alternative would have very little impact to the other resources due to the short-term impacts of constructing the central gas plant and installing the pipelines.



Alternative 2: Resource Production

Under Alternative 2, the 1-13 and 1-19 wells would be brought on line as discussed in Alternative 1, however, production facilities (storage tanks) would be located onsite.

Alternative 2 is the maximum development alternative, allowing nine step-out wells and six exploration wells. The step-out wells would require production facilities onsite, with natural gas being piped to the Gypsy Highview Plant, 15 miles east of the EIS area. Periodic removal of the condensate from the onsite production facilities would be necessary.

Produced water could be disposed of as discussed in Alternative 1.

This alternative would require 12.85 miles of new road construction and 18.7 miles of new pipeline, 7.6 miles of which would not be adjacent to an access road.

Approximately 22 miles of pipeline would be necessary: 7.6 miles of which would not be adjacent to the access road and 11.1 miles would be adjacent to the access roads. There are 3.25 miles of pipeline currently in place.

This EIS assumes the exploration wells to be dry holes. Therefore, the analysis of these wells addresses exploration through abandonment; and Section 7 Consultation with the USFWS has not been completed for the exploration wells.

Alternative 2 Consequences

Impacts to air quality would increase due to the large number of wells projected with production facilities located onsite. These impacts would not approach federal or state standards.

Hydrogen Sulfide (H_2S) is a concern. However, if American Petroleum Institute guidelines are followed during drilling, the chances of a H_2S breakout of any magnitude would be minimal.

There would be no negative impacts to the geology of the area. A positive impact would be additional subsurface geologic information gained from new drilling.

The construction activities and increased human activity associated with this alternative could create additional impacts to cultural resources.

Road, drill pad and pipeline construction would disturb the context in which fossils may be found. However, this could be a positive impact, possibly leading to new discoveries and additional knowledge.

Sixty-one acres of the proposed development in this alternative would occur on soil types with low soil stability hazards, resulting in low impacts from development. One hundred twenty acres of the development would occur on soil types with moderate hazards, increasing development costs to mitigate soil erosion and/or off site sediments pollution hazards. This alternative has the greatest soil stability risk associated with development.

This alternative would disturb approximately 181 acres of vegetation: 140 acres on forest areas, 36 acres on grassland and about 5 acres of gravel bar area. This would reduce the forage potential of the area by about 18,000 pounds of total production per year. Much of this impact would be mitigated by reestablishing the vegetation after rehabilitation of drill sites and pipelines routes.

Impacts to livestock would occur in four allotments with the loss of 118 acres of available forage. However, it is unlikely that livestock numbers would be reduced because of this loss. Impacts would be mitigated through partial rehabilitation of producing wells (those areas not needed for producing a well), reseeding pipeline corridors and complete rehabilitation of dry wells.

This alternative would create the greatest impact to wildlife and their various habitats, affecting 113,070 acres of important habitat and 99 special habitat features. Animals would be displaced due to increased vehicular access during the production phase. Impacts could be lessened through the use of timing windows during exploration.

Impacts to surface water under this alternative would be minor; most drill sites would be located away from the small amount of surface water in the EIS area. Most sediment would be transported during spring snow melt or after severe thunderstorms. Impacts would be minimized by limiting construction as much as possible in the flood plain, or by performing any construction in the floodplain after snow melt and the spring rainy season.

There would be no significant impact to groundwater because of the low volumes expected, the filtering effect of the alluvial gravels and the cementing off of all water zones to prevent interception of groundwater during drilling.

Significant impacts to visual quality would occur from this alternative. Several roads would be noticeable to all viewers and would require a number of switchbacks to access the wellsites. Two access roads would cross through the BLM's Blind Horse Outstanding Natural Area, which has a Class I visual resource management objective and no amount of design or mitigation would reduce the impacts to an acceptable level for this rating. Mitigation would involve keeping pad size as small as possible, designing developments in an uneven form, painting structures, berming well pads and height limitations.

This alternative would result in a reduction of 80 acres from a semi-primitive to a roaded natural recreation setting. Access would be increased, a positive or negative impact depending on the perspective of the person using the area and the recreation experience they hope to have.

Noise levels would increase under this alternative, due to increased development and traffic. Many of these noises would be short term. These noises could drive wildlife away from wellsite and access roads. For individual wellsites, this would not be significant. For a developing field, these influence zones could overlap and may have an adverse impact on wildlife.

Compared to the other alternatives, Alternative 2 allows the maximum development of the oil and gas resources within the EIS area. Thirteen of the 25 federal leases would be developed. The reservoir produced by the 1-5 and 1-8 wells would have an additional well drilled. The total recovery from this reservoir would range from 10.4 to 29.8 BCF. The reservoir to be produced by the 1-13 and 1-19 wells would be further evaluated by up to eight step-out wells. Production estimates for this reservoir range from 7.4 to 75.8 BCF.

Alternative 2 would require 12.85 miles of new road construction. Special design methods would be required in those areas with high slump potential. A total of 69.6 miles of road would be in use. Roads accessing non-producing wells would be reclaimed and revegetated.

Alternative 3: Resource Protection

This alternative would favor the protection of wildlife, visual resources, air and water quality and other surface resources while allowing a moderate level of oil and gas development. The alternative would adhere strictly to the Interagency Rocky Mountain Front Wildlife Guidelines (1984); which provide protective measures primarily for grizzly bears, mountain goats, bighorn sheep, elk, mule deer and raptors.

Other resources such as visual quality, air and water quality, etc., would be protected by using special construction techniques, special design techniques and special protective stipulations.

A total of nine wells would be allowed under this alternative: two existing (producing) wells, two shut-in wells brought on line, one injection well for disposal of produced water, two step-out wells and two exploration wells. Production facilities would be located off site at a central facility on private surface over private minerals.

A total of 21 miles of road would be used in this alternative. However, only 1.35 miles of new road construction would be necessary.

Approximately 17.8 miles of pipeline would be necessary to transport gas to the central production facility; 11.4 miles would not be adjacent to the access road; and 3.1 miles would be adjacent to the access road. There are 3.25 miles of pipeline currently in place.

Alternative 3 Consequences

This alternative is very similar to Alternative 2 with two major differences; gas condensate would be stored at a central production facility with remote monitoring, and there would be only two step-out wells and two exploration wells allowed.

The effects to resources would also be similar to Alternative 2, but proportionately less.

Impacts to wildlife would be much less in this alternative than Alternative 2. Approximately 55,500 acres of wildlife habitat and 37 habitat features would be affected. Remote monitoring of the wellheads from the central production facility and strict enforcement of the Interagency Rocky Mountain Front Guidelines would help mitigate impacts.

Oil and gas resource development and production would be limited under this alternative. Eighteen of 25 leases would not be developed. Timing restrictions, based on the Rocky Mountain Front Wildlife Guidelines, would delay drilling and development activities. Delays would increase costs, decrease production quantities, and, may result in the premature abandonment of producing wells.

The reservoir produced by the 1-5 and 1-8 wells would produce between 9.4 and 25.4 BCF of gas, a 1.0 to 4.4 BCF reduction from Alternative 2. Only one additional well would be drilled in the reservoir containing the 1-13 and 1-19 wells. Total production from this reservoir would range between 4.3 and 19.5 BCF.

Alternative 4: Preferred Alternative

This alternative balances Alternative 2 with Alternative 3 and allows a level of oil and gas production while protecting the resources within the EIS area. The agencies feel this alternative best meets the requirements of law and regulation as well as their obligations to oil and gas leaseholders to develop their lease while minimizing the adverse impacts to natural resources.

A total of 18 wells would be allowed: 2 existing (producing) wells, 2 shut-in wells brought on line, 1 injection well, 7 step-out wells and 6 exploration wells. Production facilities would be located off site at a central facility on private surface over private minerals. Wellheads would be remotely monitored from this facility.

Approximately 63 miles of road would be in use, (of which 20.65 miles would be closed to the public) however, only 12.25 miles of new road construction would be necessary. Approximately 40 miles of pipeline would be necessary to transport gas condensate to the central production facility; 23.9 miles would not be adjacent to the access road and 12.65 miles would be adjacent to the access route. There are 3.25 miles of pipeline currently in place.

Alternative 4 Consequences

The impacts from this alternative are very similar to those discussed in Alternative 2, but somewhat less because of two fewer wells.

Over 4,000 more acres of important wildlife habitats would be affected in this alternative compared to Alternative 2, even though there are two less step-out wells. The reason for this is because of the acres needed for the central gas processing facility and the injection well. However, the overall impacts would be less severe because of remote monitoring, resulting in less vehicular traffic to the wellsite. Ninety-two habitat features would be affected in this alternative.

Impacts to oil and gas exploration and development would also be similar to those discussed in Alternative 2. Thirteen of the 25 federal leases would not be developed. Timing restrictions, as discussed under Alternative 2, would cause similar impacts under this alternative. The reservoir being produced by the 1-5 and 1-8 wells would produce between 9.4 and 25.4 BCF of gas. Seven additional wells would be drilled in the reservoir containing the 1-13 and 1-19 wells. Total production from this reservoir would range from 6.9 to 42.8 BCF.

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ACRONYMS

AMP	Allotment Management Plan
APD	Application for Permit to Drill
BCF	Billion Cubic Feet
BLM	Bureau of Land Management
BMU	Bear Management Unit
CEM	Cumulative Effects Model
CFR	Code of Federal Regulations
CEQ	Council on Environmental Quality
db	decible
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FLPMA	Federal Land Policy and Management Act
H_2S	Hydrogen Sulfide
MCF	Thousand Cubic Feet
MDFWP	Montana Department of Fish, Wildlife, and Parks
NEPA	National Environmental Policy Act
NTL	Notice to Lease
ONA	Outstanding Natural Area
PSD	Prevention of Significant Deterioration
RMF	Rocky Mountain Front
RMFWG	Rocky Mountain Front Wildlife Guidelines
RMP	Resource Management Plan
RVD	Recreation Visitor Day
T&E	Threatened and Endangered
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service

Chapter One Purpose and Need

INTRODUCTION

This draft Blackleaf Environmental Impact Statement (EIS) was completed as an interdisciplinary and interagency effort. The Bureau of Land Management (BLM) is the lead agency, since the Bureau is responsible for permitting oil and gas exploration and development activities on federal mineral estate and because of the substantial surface acres managed by the BLM in the Blackleaf EIS area. The U.S. Forest Service (USFS) and the Montana Department of Fish, Wildlife and Parks (MDFWP) are cooperating agencies because of the significant surface acres and resources they manage within the EIS area. When this document refers to the agencies, it includes all three.

This document is organized in five chapters for the reader's convenience. Chapter 1 discusses the purpose and need for this EIS and the concerns identified through the public scoping process. Chapter 2 examines the alternative scenarios developed to address the concerns regarding oil and gas development. Chapter 3 describes the existing conditions and resources that could be affected by any of the alternatives. Chapter 4 defines the environmental consequences of each alternative and forms the basis for comparing the alternatives. It also describes the mitigation used to lessen impacts. Chapter 5 describes the public participation and coordination process.

This document adheres to the guidelines and policies established by the Federal Land Policy and Management Act, the Code of Federal Regulations, the Council on Environmental Quality, the Endangered Species Act and the National Environmental Policy Act.

SETTING

The EIS area lies in northwestern Montana, approximately 25 miles northwest of Choteau, and 70 miles south-southeast of Glacier National Park (see Figure 1.1). A portion of the EIS area lies immediately east of the Bob Marshall Wilderness Area. The western portion of the EIS area is characterized by steep rock cliffs and stream canyons; the eastern portion by foothills and plains.

The Blackleaf EIS area consists of 58,503 surface acres. Of the subsurface mineral estate, 40,327 acres are federally owned and 18,176 acres are of other ownership (see Table 1.1 and Figure 1.2).

The recommendations made in this EIS will apply only to federally managed surface and/or subsurface acreage.

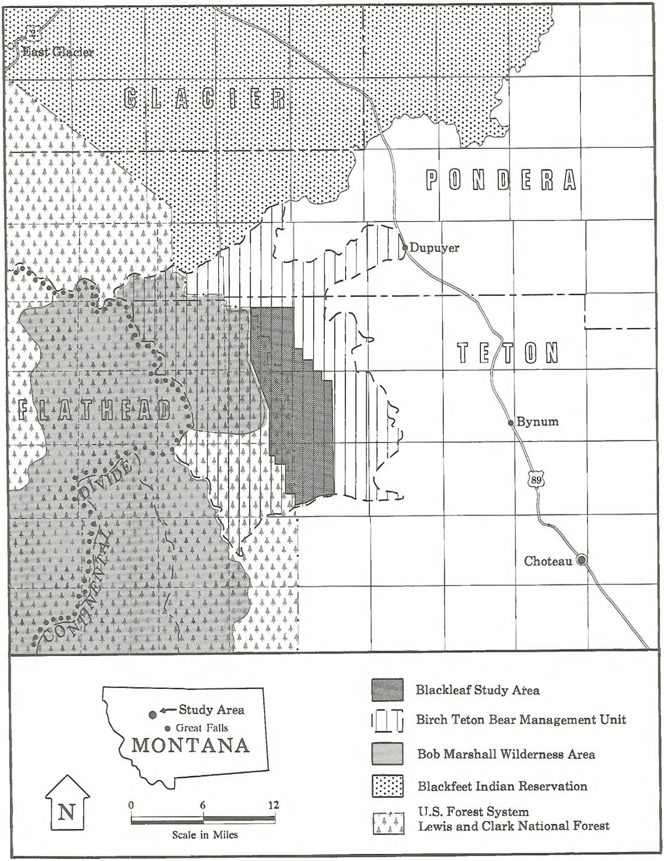
TABLE 1.1

LAND STATUS

Surface Status	Acres	Acres Federal Mineral	Acres Non-Federal Mineral Ownership
National Forest	17,603	17,603	0
BLM	5,808	5,808	0
Montana Dept. of State Lands	3,162	1,067	2,095
Montana Dept. Fish, Wildlife and Parks	8,158	4,237	3,921
Private	23,772	11,612	12,160
TOTAL	58,503	40,327	18,176

BLM, 1989.

Figure 1.1 Location Map of Blackleaf EIS Study Area and Birch Teton Bear Management Unit



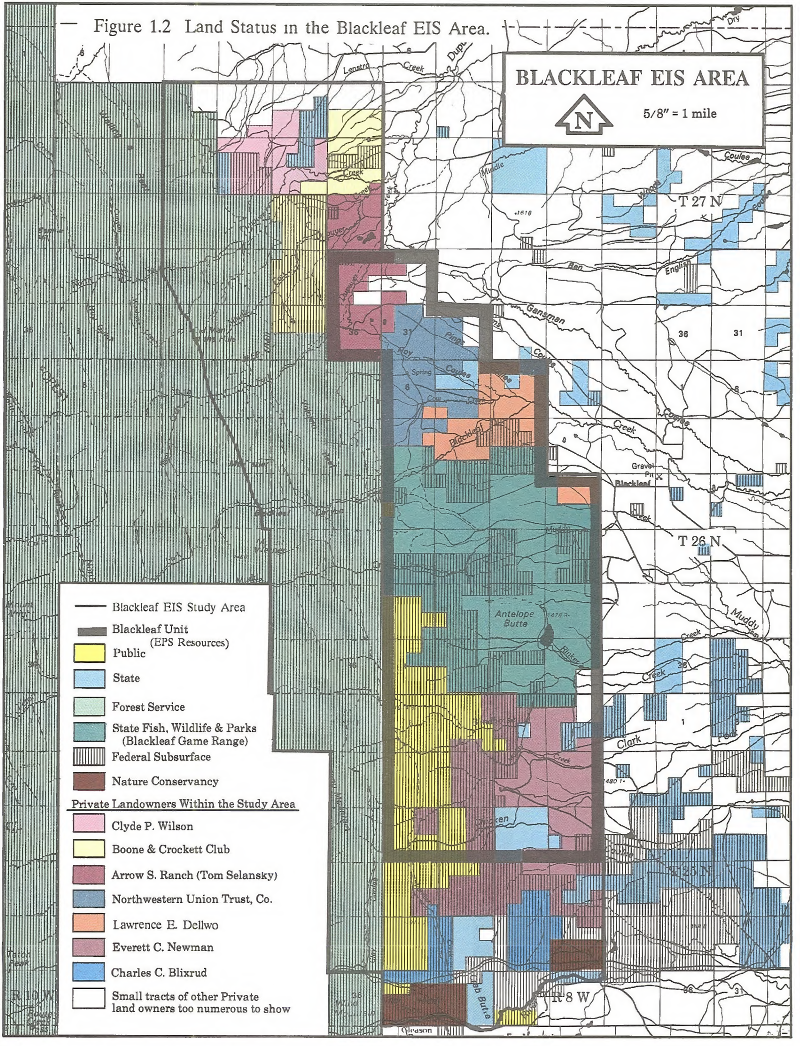


Figure 1.2 Land Status in the Blackleaf EIS Area.

PURPOSE AND NEED FOR THE PROPOSED ACTION

The EIS area has provided some level of mineral exploration and development since the 1930s. A digest of this activity plus the unitization process is given in Appendix A.

At least a portion of the EIS area contains an identified natural gas resource. Approximately 25,000 acres of the 58,503 acres in the EIS area form the Blackleaf Unit (see Figure 1.2). Currently there are two producing wells, two shut-in wells capable of production and one temporarily abandoned well proposed for water injection in this unit. EPS Resources Corporation is proposing further development in the Blackleaf Unit.

All of the federal minerals in the EIS area have been leased (there are currently 25 leases within the EIS area). The BLM's decision to issue the oil and gas leases was based on recommendations from the BLM Butte District Manager and the USFS Regional Forester. The Butte District Manager based his recommendations on the Oil and Gas Leasing in the Butte District Environmental Assessment (September, 1981). The Regional Forester based his recommendation on the Oil and Gas Leasing of Nonwilderness Lands on the Lewis and Clark National Forest Environmental Assessment (1981).

The EIS area also provides habitat for a significant amount of wildlife, including several threatened and endangered (T&E) species; contains outstanding scenic qualities; provides a variety of recreational opportunities; is important to the tourist industry; is near the Bob Marshall Wilderness Area; and contains an area designated by BLM as an outstanding natural area (ONA). The region has become a focal point for national debates about resource uses.

Because of the rights and expectations of oil and gas lease holders; the nature of oil and gas exploration and development; public concerns; the occupied T&E species habitat; the many resource values present in this region; recommendations from other agencies; and because BLM policy calls for a field development level analysis after the second well in a field has been developed, the Lewistown BLM District Manager and the Lewis and Clark National Forest Supervisor decided an EIS should be prepared.

The intent of this EIS is not to simply approve or deny one resource use over another. The objectives of this EIS are to: look at reasonable alternatives for full field development of the Blackleaf Unit; and to provide a full discussion of any significant environmental impacts and cumulative effects that may result from full field development. Full field development includes all development activities including exploration, production facility development, placing transportation networks and abandonment. This EIS also explores ways to avoid, minimize or otherwise mitigate adverse impacts to the resources common in the EIS area.

The decisions made through this EIS should be valid for the life of the Blackleaf Unit, which is estimated to be 25 years at current production rates and the area immediately surrounding this unit.

SCOPE OF THE ANALYSIS

The scope of this analysis is to analyze the cumulative impacts of reasonably foreseeable full field development in the Blackleaf EIS area. Both step-out and exploratory wells are part of a reasonably foreseeable full field development scenario. However, this EIS only analyzes exploratory wells from exploration (drilling) to abandonment (there is a 90-percent probability these wells will be dry holes). Since the EIS does not project production figures for the exploratory wells, Section 7 Threatened and Endangered Species Consultation with the U.S. Fish and Wildlife Service has not been completed on these wells. Therefore, the filing of an Application for Permit to Drill for one of these exploratory well sites would require additional NEPA analysis and complete Section 7 Consultation.

Development activities on private surface over private minerals are not under federal control. However, the reasonably foreseeable development scenarios indicate this is a possibility and the analysis of cumulative effects includes development on these lands.

This document does not address the effects of seismic exploration. The BLM's Blind Horse Outstanding Natural Area Activity Plan/Environmental Assessment and Headwaters Resource Management Plan/EIS and the USFS's Lewis and Clark National Forest Plan address specific management guidance for seismic exploration. This EIS does not change that guidance.

ISSUES

The general public, local civic leaders and personnel from the BLM, USFS, MDFWP, and other government agencies were asked to help define the major concerns regarding oil and gas development in the EIS area. Public meetings were held in Choteau, Great Falls, Missoula, Browning, Cut Bank and Helena in the fall of 1985, to further solicit public comments. The BLM and USFS also received 13 letters from individuals and groups commenting on issues and concerns. All of these comments were categorized in the following manner.

What would be the impacts of oil and gas development on:

1. wildlife (especially grizzly bears, elk, deer, bighorn sheep, Rocky Mountain goats & rapators);
2. the scenic quality of the EIS area;
3. the adjacent Bob Marshall wilderness area;
4. the economic foundation of the area;
5. area landowners;
6. the health and safety of area residents;
7. tourism and recreation; and
8. what would be the cumulative effects of oil and gas development?

EXISTING MANAGEMENT DIRECTION

Two federal agencies, the Bureau of Land Management and the U.S. Forest Service, manage lands within the EIS area. The public lands administered by the BLM are managed under the guidance found in the Headwaters Resource Management Plan (RMP) (Record of Decision, 1984). U.S. Forest Service lands are managed under the direction of the Lewis and Clark National Forest Plan (Record of Decision, 1986). Valid, existing management direction from previous planning efforts was incorporated into both of these plans.

Through the Headwaters RMP, the majority of public land (4,927 acres) managed by the BLM in the EIS area was designated as the Blind Horse Outstanding Natural Area. The management direction in this ONA allows those multiple uses that do not degrade the natural qualities of the area and disallows those that do, or modifies them to retain the natural and scenic beauty of the area. The Blind Horse Outstanding Natural Area is presently leased for oil and gas exploration with existing rights.

The Headwaters RMP also recommended thorough interagency coordination for the Rocky Mountain Front (RMF), along with the application of all normal mitigating measures and special stipulations, when necessary, prior to lease issuance. Protective stipulations for threatened and endangered species, visual and watershed values, and cultural resources were attached to all leases. Many of the older BLM leases along the RMF, including those within the Blackleaf EIS area were leased prior to the Headwaters RMP of 1984, and are currently held by production. When these leases expire, they may or may not be released, depending on the management direction outlined in the Headwaters RMP. Based on the more detailed oil and gas data available through this EIS and the Bureau's recent guidance on the oil and gas data required in RMPs/EISs, the Headwaters RMP/EIS will be amended to provide more detailed oil and gas information.

The Lewis and Clark National Forest Plan provides long-term management guidance for the Lewis and Clark National Forest. It describes resource management practices, levels of resource production and management and the availability and suitability of lands for resource management. All permits, contracts and other instruments for the use and occupancy of the National Forest System lands must conform with the forest plan. The forest plan does not make leasing decisions. Additional National Environmental Policy Act (NEPA) analysis will be completed prior to issuing new oil and gas leases on the Lewis and Clark National Forest. Of the 58,503 surface acres within the Blackleaf EIS area approximately 17,603 acres are managed by the Lewis and Clark National Forest. The federal mineral estate beneath all of this acreage is managed by the BLM. Of the 17,603 acres, 6,855 acres have no surface occupancy restrictions attached to the lease; 12,080 acres have timing restrictions; and 230 acres have limited surface use restrictions.

One state agency, the Montana Department of Fish, Wildlife and Parks, also manages lands, the Blackleaf Wildlife Management Area (WMA), within the EIS area. Their draft Blackleaf Wildlife Management Area Management Plan (Final, 1990) outlines goals, objectives, monitoring requirements, travel plan, etc. for the 8,158 acre WMA.

A Comprehensive Development Plan for Teton County, Montana was developed in 1981, by the Teton County Planning Board. The purpose of this plan is to protect and improve the present health, safety, convenience and welfare of county citizens and to plan for the future development of their communities; that the needs, industry, and business be recognized in future growth; and that growth of the communities be commensurate with and promotive of the efficient and economical use of public funds. The plan also proposes to protect and maintain the agricultural economy of the county and to protect valuable agricultural areas; to conserve energy; and to result in the development of better communities, the preservation of desirable environments and a general all around improvement in the quality of life.

INTRODUCTION

Four alternatives, including the agencies' preferred alternative, are described in this chapter in order to provide a means of comparing alternatives. The chapter is organized in five sections: the Process Used To Formulate Alternatives; Alternatives Eliminated From Detailed Consideration; a General Oil and Gas Operation Scenario; a Description Of The Alternatives Considered; and a Comparison Of The Alternatives (tables at the end of the chapter).

Because of the number and complexity of the activities projected in some alternatives, this chapter uses several methods to track information. The text in each alternative description describes most activities in terms of their name, location and geographic references. Each alternative description contains at least two figures: one a schematic showing activities and their related developments; the second showing the same activities and developments over a topographical base. Each alternative description also contains an outline of the activities it projects.

Also, each activity was given an alpha/numerical code; step-out wells will be called S-1, S-2, etc., exploration wells E-1, E-2. Other needed items are referred to by the code of the wellsite they serve and their function (i.e., the S-1 pipeline, the E-2 road etc.). Producing wells will be known by their current numerical code (the 1-13 well, the 1-8 etc.).

PROCESS USED TO FORMULATE ALTERNATIVES

In February 1985, the agencies first agreed that an environmental impact statement (EIS) was needed to analyze full field development in the Blackleaf area. They began contacting the public and other agencies to define issues and then began formulating criteria and alternatives. Other agencies with expertise in various technical fields were consulted as was the oil and gas industry. Alternatives were developed in accordance with the National Environmental Policy Act of 1969 (NEPA) which requires that alternatives be reasonable, feasible and available in intent and in implementation. The alternatives were designed to focus on possible methods of development rather than merely on approval or denial.

There were an infinite number of possible alternatives concerning wellsite selection, road access, facility siting, etc. To limit these possibilities to a reasonable number, the alternatives were designed to be conceptual in nature, rather than locked into specific sites that may or may not prove realistic. Thus a "scenario" concept was used to develop the alternatives. This approach was based on BLM's current knowledge of the geology of the area; a realistic development program; available drill hole data; and BLM's best professional judgement. New access roads associated with these scenarios are construed to be corridors approximately 1/4-mile wide. The actual road location (to be determined at Application for Permit to Drill (APD) time by an onsite inspection) would be within that corridor. The actual wellsites, roads and other facilities could be in slightly different locations when actual applications are submitted.

If BLM receives an Application for Permit to Drill for a location discussed in this EIS, additional NEPA analysis may be required prior to surface disturbance. This analysis would be tiered to this EIS and would consider the site specific wellsite placement, cultural resources clearances, threatened and endangered (T&E) species assessment and road placement. Additional T&E species consultation with the United States Fish and Wildlife Service (USFWS) would not be necessary.

However, should BLM receive an APD for a location that is significantly different than those discussed in this EIS, or should other factors result in impacts not analyzed in this document, the Bureau would commit to additional NEPA analysis and formal T&E species consultation with the USFWS. Based on this analysis and consultation, the APD may be approved as submitted, approved subject to modification or stipulations, or denied.

Exploration wells are a normal component of field development and while no APDs for any exploration well have been received, our best professional judgement indicates industry may have an interest in exploring these areas within the life of this EIS. Based on the complexity of the geology of the EIS area and because the gas traps are so small, this analysis assumes the exploration wells would be dry holes (a 90-percent probability based on past experience). Therefore, the analysis of these wells includes exploration through abandonment, with no production figures in any alternative scenario. Since the EIS does not project production figures for the exploratory wells, Section 7 T&E Consultation with the US Fish and Wildlife Service has not been completed on these wells. Therefore, an APD for one of these exploratory well sites would require additional NEPA analysis and complete Section 7 Consultation.

The time frames given in Alternatives 2, 3 and 4 are the assumed order in which wellsites would be drilled (based on conversations with industry representatives). The wellsites could be drilled in any order, based on the operator's preference.

Standard management practices (see Appendix B) are the result of existing laws, regulatins, and previous planning efforts and were automatically built into each alternative description. Current lease stipulations (see Appendix C) are in place to protect other resources from undue degradation and were also considered in the alternative scenarios.

ALTERNATIVES ELIMINATED FROM DETAILED DISCUSSION

The following alternatives were considered, but not analyzed.

1. Full Field Development Based on State Spacing Requirements

   This alternative would have analyzed every lease in the EIS area being developed with a wellsite in every section (every 640 acres or less). This scenario would be the worst case analysis from the environmental perspective. It would have involved a minimum of 80 wellsites and required a road system totalling over 100 miles. In the best professional judgement of agency and industry experts, the possibility of this type of development in the Blackleaf EIS area is extremely unlikely.

2. "Retroactive" No Action Alternative

   This alternative would have retroactively revoked drilling rights and developments in the area since 1981. It would require companies to remove facilities, cap producing wells and rehabilitate the area to a natural condition. This would be, in effect, a condemnation action by the federal government and a "taking" of private property rights that would have to be fully compensated; making it extremely expensive. Not only would the leases have to be bought back, but the cost of drilling, facilities and the loss of known reserves would have to be considered. Costs to the government could be in the hundreds of millions of dollars and this alternative would be difficult to sustain legally and environmentally.

3. Airlift Mobilization (Helicopter Access) Alternative

   This alternative would have required airlifting all materials and services required to drill the anticipated wells from a mobilization platform to the wellsite in lieu of building roads. Although the agencies believe this is a valid alternative for wells in unroaded areas, it is not valid for the Blackleaf EIS area because 70 percent of the area currently has road access (is within 1 mile of an existing road).

   Helicopter mobilization is extremely expensive and could be prohibitive for the number of wells considered here. The overriding concern however, is that this EIS is primarily analyzing field development scenarios. Thus, the agencies are assuming production from step-out wells that will, sooner or later, need pipelines, powerlines and access roads or trails for construction, maintenance, monitoring and finally, rehabilitation.

GENERAL OIL AND GAS OPERATION SCENARIO FOR A FEDERAL LEASE

Since the alternatives considered in this EIS analyze differing levels of field development activity, this description of a typical gas development process may be of value.

A seismic program is conducted to select potential development areas. In roadless areas, this is usually accomplished by laying surface charges, exploding the charges and recording the information. Roads or other facilities are not built. Crews are transported by helicopter or traverse the area by foot. Along roads, the work will often be done via the shot hole method where a truck mounted drill rig drills holes and sets the charges which are then exploded and the data recorded. Vibro-seise equipment may also be used in roaded areas (a large metal weight is dropped or vibrated on the ground). The shock waves created by these methods are reflected by underground formations and the data recorded. It usually takes less than 2 weeks for a seismic crew to explore an area.

Once this data has been analyzed, potential drilling locations are located, surveyed and staked on the ground. A gravel road, 12 to 16 feet in width and capable of handling large truck traffic, is built to the site and the drill pad is constructed. Construction time frames for roads vary due to steepness of slope, the types of soils, the presence or absence of timber, etc. In the EIS area any individual road can probably be built in 1-2 weeks. Drill pads are normally 2-5 acres in size and normally take less than a week to complete. This includes room for the drill rig, pipe and equipment storage, parking space and room for construction of one or more mud pits to contain drilling muds and fluids used in the drilling operation. Once drilling has started it can be expected to continue 24 hours a day, 7 days a week continuously for an average of 60-90 days. Typical wells are 6,000-8,000 feet deep and may take up to 120 drilling days to complete.

If the well is capable of producing enough gas to be economically viable, production facilities are added to the site. These facilities include separation facilities, evaporation ponds, condensate tanks and perhaps vapor recovery apparatus. For the Blackleaf EIS area those facilities could be described as follows: from the wellhead, gas is piped into a building that is normally locked for security and safety reasons due to the presence of Hydrogen Sulfide (H_2S) gas. Inside the building, the piped gas enters a separation unit, where the water is separated from the gas and disposed of.

Gas condensate (liquid gas) is piped out the other side to condensate tanks where it is held and accumulates until it can be trucked off site to a processing plant. These condensate tanks are typically 12 feet in diameter and 20 feet or more high. A flare stack extending 25-30 feet high or more is in place outside the building in case production testing or emergency gas flaring is required. Optional equipment includes a glycol injector (added if the gas is to be transported very far to a processing plant) and a compressor station (used if reservoir and/or wellhead pressures are not sufficient to move the gas to the plant).

Pipelines will normally disturb an additional area 10-12 feet wide when constructed adjacent to existing roads, to provide room for machinery, access, spoil piles and the ditch. This width may be slightly wider in forested areas (up to 50 feet wide if going cross country) to provide operating room for machinery. There is no pipeline proposed in any of the alternatives that would take more than 30 days to complete.

A powerline to supply electricity for the site is also brought in. These are normally small distribution lines which follow the existing road right-of-way. They are usually above ground lines, unless special circumstances require their burial.

Daily/weekly inspections and periodic maintenance at the wellhead are needed for the life of the field (approximately 25 years).

Once the field is abandoned the facilities are removed, the area recontoured, reseeded and returned to as natural a condition as possible. Roads, unless needed for other purposes, are also rehabilitated.

If the well is a dry hole, the wellsite is rehabilitated and recontoured. The road may also be rehabed on a case-by-case basis.

Table 2.1 shows the various phases of petroleum development and the activities occurring during each phase.

DESCRIPTION OF THE ALTERNATIVES

These alternative scenarios were developed to address the concerns identified in Chapter 1. Alternative 1 is essentially the No Action Alternative while Alternatives 2, 3 and 4 are variations in the number of wells to be drilled.

A common trait among all the alternative scenarios would be the methods used to dispose of produced water.

1. If the volume of produced water is small enough (less than 5 barrels/day), it could be disposed of on location in a fenced, lined surface pit.

TABLE 2.1

PHASES OF PETROLEUM DEVELOPMENT AND ACTIVITIES OCCURRING DURING EACH PHASE[1]

Activity	Development Phase				
	Explore	Drill	Develop	Produce	Abandon
Ground surveys	X				
Seismic trail clearing	X				
Seismic wave production/recording	X				
Clearing/grading right-of-way		X	X		
Road construction	X	X	X	X	
Mobilization of trucks/equipment	X	X	X	X	
Site development (clearing/grading)		X	X	X	X
Drill pad construction		X	X		
Excavation of storage/mud pits		X	X		
Drilling and related activities		X	X		
Water supply		X	X		
Borrow pit excavation		X	X		
Wellhead/pump unit installation			X		
Construction of process/treatment/ storage facilities				X	
Installation of flow lines				X	
Erection of power lines				X	
Communication system development				X	
Operation of process/treatment facilities				X	
Pipe stringing				X	
Trenching and pipe installation				X	
Pipe burial and backfill				X	
Maintenance and inspection				X	X
Accidents		X	X	X	X
Secondary recovery				X	
Air support	X	X	X	X	X
Worker accommodations		X	X	X	X
Increase in local population		X	X	X	
Development of ancillary industry				X	
Well plugging					X
Site restoration/revegetation					X

Source: Bromley, M., 1985.

2. The water could be stored on location in a large holding tank, requiring periodic removal by vehicle.

3. The water could be piped to a facility where it would be readied for injection into the 1-16 injection well, and injected into the same geologic formation it was taken from. The pipelines running from the wellsites to the injection facilities would be placed beside the hydrocarbon lines in the same trench. The 1-16 injection well is in place and would only require a pipeline from each wellsite or the central gas facility. These pipelines are included in each alternative discussion and the 1-16 injection well is included in each alternative outline, but is not discussed further.

Alternative 1 — No Action

This alternative would essentially preclude all further federal oil and gas exploration or development activities in the Blackleaf EIS area. The two wells already drilled and producing (1-5 and 1-8 on Figures 2.1 and 2.2) and the two wells drilled and capable of production (1-13 and 1-19 on Figures 2.1 and 2.2) would be allowed to produce to legally abide by the terms of the lease, the Mineral Leasing Act of 1920, and Onshore Order Number 1. No further exploration or development of the area would be allowed. All gas would be processed (sweetened) at a central gas processing facility located on private surface over private minerals. For a complete description of this facility, refer to Appendix D.

The following outline lists the activities included in this alternative.

Alternative 1 Outline

Existing Producing wells	2
Existing Shut-in wells brought on line	2
Proposed Injection wells	1
Proposed Step-out wells	0
Proposed Exploration wells	0
Total wells	5
Proposed Gas processing facility (private surface and private mineral)	1
Total road miles in use	16.4*
Total new road construction	0
New pipeline not adjacent to well access roads	4.1 miles
New pipeline adjacent to well access roads	1.1 miles
Existing pipeline	3.25 miles
Total pipeline miles	8.45
Timeframes	
Active development program	1-2 years (1991-1992)
Well field maintenance	31 years (1983-2014)
Wellsite abandonment and rehabilitation	1-2 years per wellsite/facility

*The total road miles figure reflects counting some segments of the total road system multiple times, since some segments would be used to access multiple wells. This was done to give the reader the total length of road to be used for each wellsite.

Alternative Description

The two producing gas wells (1-5 and 1-8) would remain active. However, the storage facilities would be removed and the gas piped to a centrally located gas processing facility on private surface over private minerals (NE¼, Section 8, T. 26 N., R. 8 W.). The gas processing plant would not be a federal action and would require no federal approval. The 1-5 and 1-8 sites would be partially rehabilitated, the water disposal pits filled in and the locations reseeded with native vegetation. The only facilities remaining at each site would be a wellhead contained inside a small building, and separation and dehydration facilities to separate the water and hydrocarbons. There would be no new gas pipelines from either of these sites to the gas processing facility, as these pipelines already exist. The gas processing facility would be constructed approximately where these two existing pipelines join.

The two existing gas wells capable of production, but shut-in because they lack pipelines (1-13 and 1-19) would be brought on line via two short pipelines. Both of these lines would cross the Montana Department of Fish, Wildlife and Parks (MDFWP) Blackleaf Wildlife Management Area. One would be a 2.2-mile pipeline (of which 1.0 mile would be buried adjacent to the access road) from the 1-13 well at the mouth of the Blackleaf Canyon to the processing facility. The second would be a 3.0-mile pipeline (of which 2.9 miles would not be adjacent to the well access road) from the 1-19 well to the gas processing facility. The only facilities at each wellsite would be the wellhead contained inside a small building, some corrosion inhibitors to be injected into the gas stream prior to putting it into the pipeline, and the separation and dehydration equipment. No new road construction or reconstruction would be necessary for these existing wells.

There is an existing 3.95 mile road accessing the 1-13 well and an existing 4.6-mile road accessing the 1-19 well. Table 2.2 details the road management portion of this alternative. Those well access roads that are not currently part of the public access system would be closed to public use. Existing arterial and collector roads in the area would remain open to public use to maintain public access (see Figure 2.3).

The actions required to bring these wells (1-13 and 1-19) into production would include engineering and surveying for the pipeline routes, digging the trench for the pipe, laying the pipe, backfilling the trench and reseeding the disturbed area with a native species mixture. This mixture and other rehabilitation requirements would be at the discretion of the surface managing agency, in this case, the Montana Department of Fish, Wildlife and Parks and the U.S. Forest Service (USFS).

All gas produced by these four wells would be sweetened (Hydrogen Sulfide (H_2S) removed) at the central gas processing facility (see Appendix D). The gas would then be piped east through existing pipelines around the Gypsy Highview Plant to eventually tie in to a Montana Power Pipeline for delivery to commercial markets. Produced water would be disposed of as discussed in the Description of the Alternatives section.

Figure 2.1 Alternative One Schematic.

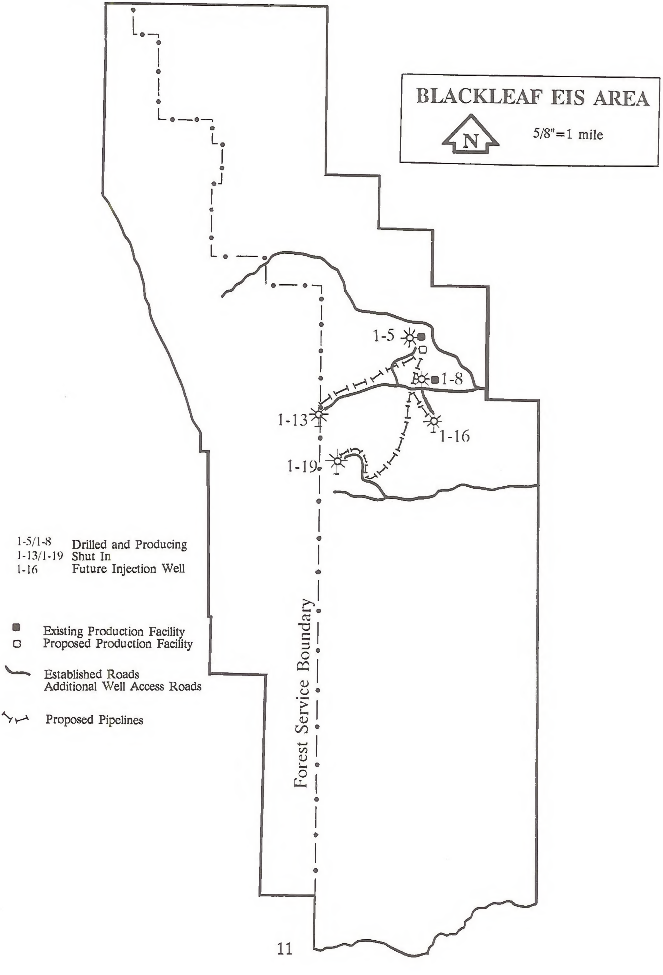


Figure 2.2 Alternative One.

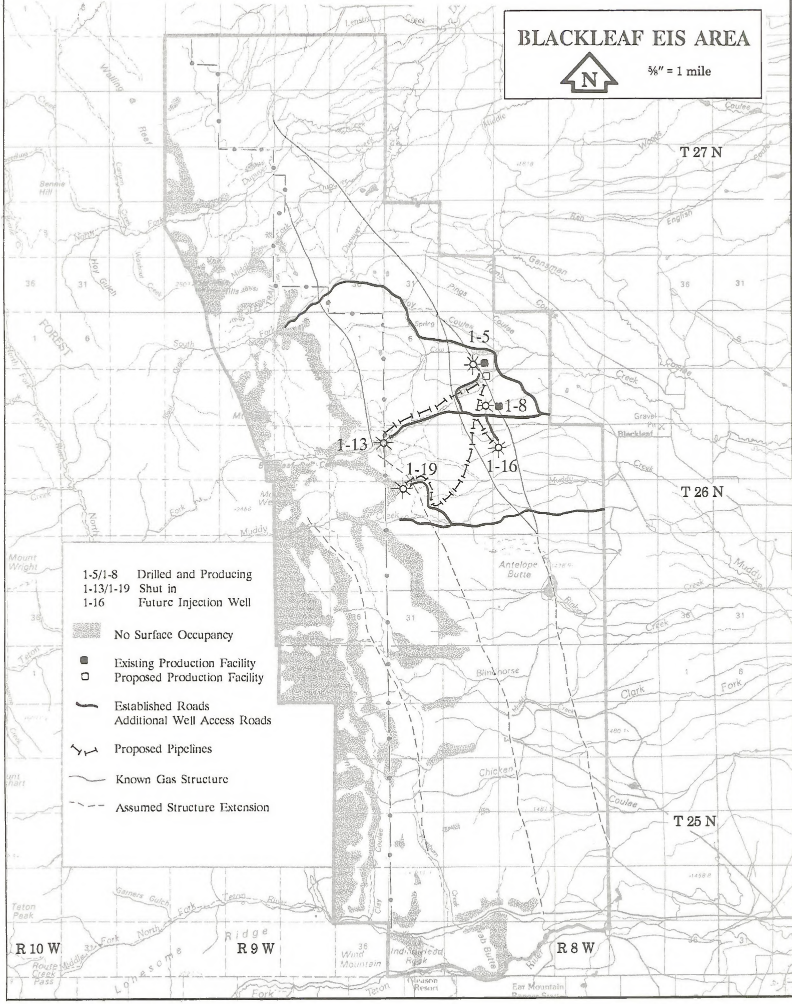


Figure 2.3 Access Routes in Alternative One.

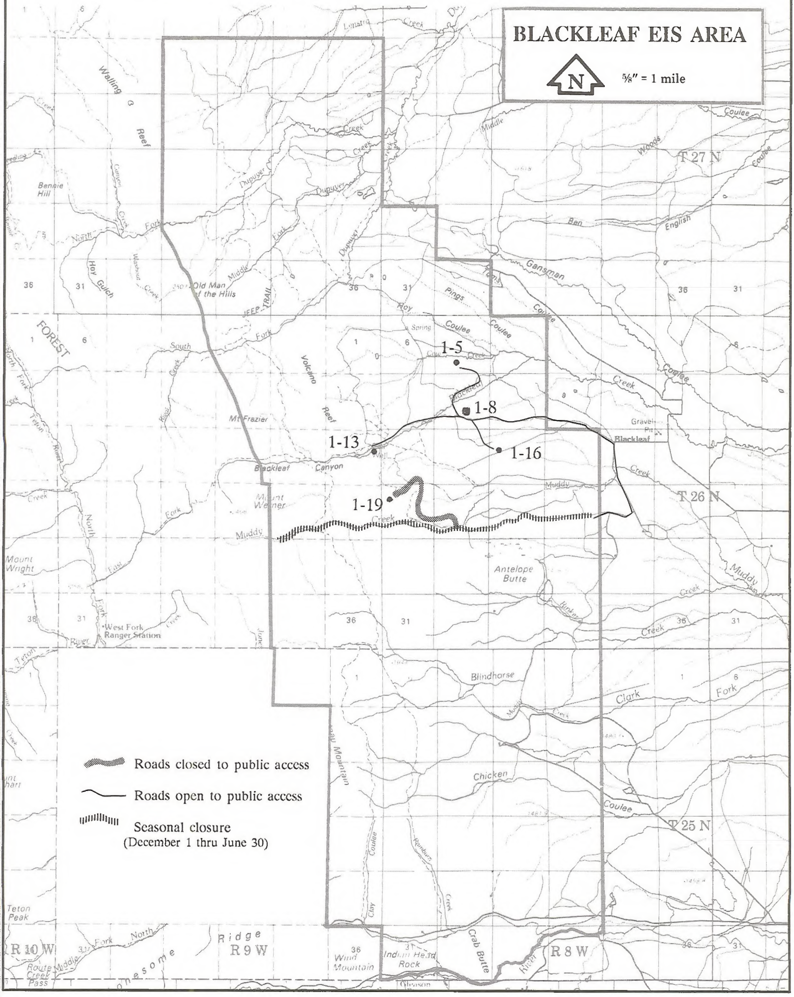


TABLE 2.2

ROAD MANAGEMENT
ALTERNATIVE 1[1]

	Additional Road Work Required			Total Road System to Nearest Maintained Public System			
Wellsite	Construction (Miles)	Reconstruction (Miles)	Total Construction and Reconstruction (Miles)	Roads Open to Public Use (Miles)	Roads Closed to Public Use (Miles)	Access Roads to be Reclaimed (Miles)	Period (Years)
1-13	0.00	0.00	0.00	3.95	0.00	0.00	1983-2025
1-19	0.00	0.00	0.00	0.40	4.20[2]	0.00	1983-2020
1-5	0.00	0.00	0.00	3.40	0.00	0.00	1991-2030
1-8	0.00	0.00	0.00	2.25	0.00	0.00	1991-2026
1-16	0.00	0.00	0.00	0.50	0.00	0.00	
Totals	0.00	0.00	0.00	10.50	4.20	0.00	

[1]BLM & USFS, 1989.

[2]From December 1 to June 30 the entire road is closed to the public via a MDFWP seasonal closure. That portion of the road that accesses only the wellsite is closed to the public year-round.

The activities related to constructing and operating this gas processing facility would include upgrading the existing road to the site and blading the site. The processing building would be a modular type brought in via truck; final assembly would occur on site. The plant would be a closed system; all gas processing by-products, such as H_2S and SO_2, NOX etc., would be contained within the plant.

Each wellsite would be remotely monitored from this processing facility via computer. Through the first year of operation, or at least through the first winter, each well would be visited a maximum of once per day, unless problems require additional visits. The wells could then be visited every third day to once per week (Ed Neibauer 1989, EPS Resources, personal communication). A three person crew would work at the plant once operations began.

Remote monitoring would require electricity at each wellsite. Powerlines would be a combination of above ground and underground lines, based on case-by-case analysis of visual resource quality and other resource objectives. These powerlines would generally be built adjacent to roads and/or pipelines.

The gas bearing structures being tapped by the wells would cease production in about 25 years. Then the wellheads, gas processing facilities, pads and roads would be removed and the areas rehabilitated to as near natural conditions as possible.

Future APDs in the EIS area would be rejected. Those leases in the Blackleaf Unit would be held by the existing producing wells until the unit contracts to the participating areas (those areas actually being drained). After contraction of the Blackleaf Unit (which would occur approximately 1 year following the completion of this EIS) those leases contained in the participating areas would be valid until all wells in the participating area are plugged and abandoned.

This alternative does not preclude a private mineral lease on private surface from exploration and/or development within the EIS area, as that would be a non-federal action.

It's assumed the development actions in this alternative would occur within 1-2 years following approval of the action. The maintenance and rehabilitation work would last until approximately 2014.

Alternative 2 — Oil and Gas Exploration and Production

This alternative would allow the oil and gas industry to develop, with minimal restrictions, the known energy resources within the Blackleaf EIS area. The locations projected in this alternative are based on the surface geology and existing drill hole information and reflect the standard methods used for developing energy resources on federal mineral estates. The locations shown in this alternative include all known areas of interest to industry as well as high potential sites identified by agency personnel (see Appendix E).

Production facilities (condensate tanks and sepration equipment) would be located on site and would require a daily to weekly maintenance visit to each site by oil field personnel. Gas would be piped to the junction of the 1-5 and 1-8 pipelines, where it would tie-in and continue on to the Gypsy Highview Plant.

The following outline lists the activities included in this alternative:

Alternative 2 Outline

Existing Producing wells	2
Existing Shut-in wells brought on line	2
Proposed Injection well	1
Proposed Step-out wells	9
Proposed Exploration wells	6
Total wells	20
Gas processing facility	0
Total road miles in use	69.6*
Total new road construction	12.85
New pipeline not adjacent to well access roads	7.6 miles
New pipeline adjacent to well access roads	11.1 miles
Existing Pipelines	3.25 miles
Total Pipeline Miles	21.95
Timeframes	
Active drilling program (new)	7-9 years (1991-1998)
Well field maintenance	35-40 years (1983-2025)
Wellsite abandonment and rehabilitation	Last 15 years of field life (2010-2025)

*The total road miles figure reflects counting some segments of the total road system multiple times since some segments would be used to access multiple wells. This was done to give the reader the total length of road to be used for each wellsite.

Alternative Description

There are currently two known natural gas structures in the Blackleaf EIS area. One is the producing structure being served by the 1-8 and 1-5 wells. The other is the structure tapped by the 1-13 and 1-19 wells, which are currently shut-in, but capable of production. This alternative includes production facilities at each of these four wellheads.

In accordance with Onshore Order Number 1, the two existing gas wells capable of production, but shut-in because they lack pipelines (1-13, 1-19) would be brought on line as discussed in Alternative 1. Both of these lines would cross the MDFWP Blackleaf Wildlife Management Area.

The first priority for additional wells in this alternative would be step-out wells to define the extent of the two known existing structures and to produce those structures at their optimum rate.

All of the step-out wells discussed in this alternative are shown on Figures 2.4 and 2.5. Table 2.3 shows the road construction and reconstruction projected with this alternative.

TABLE 2.3

ROAD CONSTRUCTION AND RECONSTRUCTION ADDITIONAL ROAD WORK REQUIRED ALTERNATIVE 2[1]

Wellsite	Construction (Miles)	Reconstruction (Miles)	Total Construction and Reconstruction (Miles)
B-1	0.00	0.00	0.00
1-16	0.00	0.00	0.00
S-1	0.00	0.00	0.00
S-2	1.25	0.75	2.00
S-3	0.25	0.20	0.45
S-4	1.25	0.00	1.25
S-5	2.25	0.00	2.25
S-6	1.40	0.00	1.40
S-7	0.75	0.00	0.75
S-8	0.00	4.50	4.50
1-13	0.00	0.00	0.00
1-19	0.00	0.00	0.00
1-5	0.00	0.00	0.00
1-8	0.00	0.00	0.00
E-1	0.1	0.00	0.10
E-2	2.80	0.00	2.80
E-3	2.80	1.10	3.90
E-4	0.00	1.00	1.00
E-5	0.00	3.30	3.30
E-6	0.00	2.00	2.00
Totals	12.85	12.85	25.7

[1]BLM & USFS, 1989.

Figure 2.4 Alternative Two Schematic with Step Out Wells.

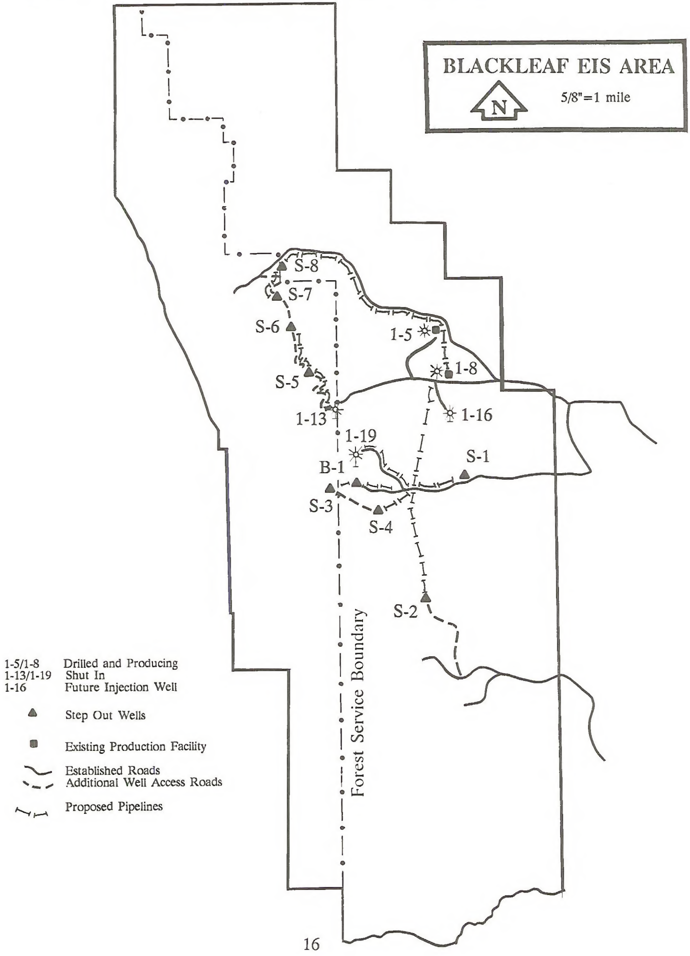
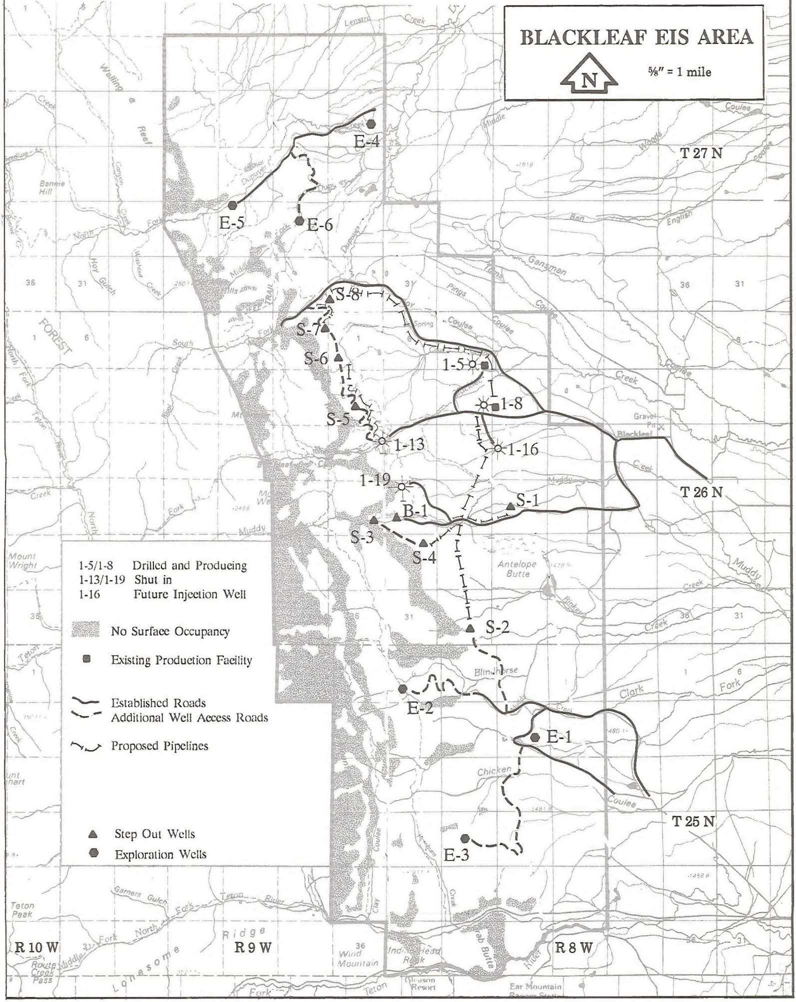


Figure 2.5 Alternative Two.



The first priority for additional wells in this alternative would be step-out wells to define the extent of the two known existing structures and to produce those structures at their optimum rate.

The easternmost structure, currently served by the 1-8 and 1-5 wells would be further defined by drilling the S-1 well, 0.5 mile due north of the Antelope Butte Swamp (T. 26 N., R. 8 W., Section 21). This is the only well proposed for this field as the addition of one well should bring it to capacity. This wellsite would be accessed by 1.5 miles of existing road and the drill pad would be 3-4 acres in size. If this well is a producer, a 1.3-mile pipeline would be constructed adjacent to the well access road from this site to the junction with the pipeline coming from the 1-19 well, which then turns north 2.1 miles to the 1-8 production facility. It is assumed the S-1 well would be drilled in mid 1993.

The westernmost field, currently served by the 1-13 and 1-19 wells, would have as many as eight step-out wells ranging north and south of the existing wells. The first priority would be to reenter the old B-1 well (T. 26 N., R. 8 W., Section 19, NE¼SW¼). This well was originally drilled in 1958, and produced approximately 900-1,000 thousand cubic feet (MCF) of gas per day. At that time there was no market for natural gas and the well was shut-in until 1973, when the well was plugged and abandoned and the site restored. At today's prices this well is commercially viable. The site lies in the bottom and at the mouth of Muddy Creek Canyon in the Blackleaf Wildlife Management Area.

Drilling the B-1 well would entail reentering the old drill hole and completing it as a producer. The well would be accessed by 3.7 miles of existing road. The drill pad should be 1-2 acres and the time on site should be 30 days or less. Once completed, production facilities would be installed and a 1.1-mile pipeline constructed adjacent to the well access road down Muddy Creek, to the junction where the 1-19 pipeline intersects the road in Section 20. The pipeline would then turn north to the 1-8 wellsite. This action would occur in the first year of operation and run concurrently with the 1-13 and 1-19 well activities.

The next priority, assumed to occur the second and third years of operation (1992-93), would be to test the western and southern limits of the field with three step-out wells (S-2, S-3 and S-4). It's assumed the first of these wells drilled would be S-3 (T. 26 N., R. 9 W., Section 24, SE¼) which would test the western extent of the field.

The S-3 site would require using 3.55 miles of existing road, about 0.25 mile of new road construction, and 0.2 mile of road upgrading from the B-1 wellsite. Any pipeline needed for this well would run adjacent to the road for 0.65 mile to tie into the B-1 well pipeline.

The southern limits of the structure would be explored with the S-2 well located on the divide between Rinker and Blind Horse Creeks (T. 26 N., R. 8 W., Section 32). This would require about 1.25 miles of new road construction, about 0.75 mile of road reconstruction and one crossing through Blind Horse Creek. The drill pad would be 3-5 acres in size. If the well produces, a pipeline would run north 1.8 miles to join the line coming from the S-3 and B-1 wells in the SE¼ of Section 20.

The last step-out well for the southern portion of this structure (S-4) would be located on the MDFWP Blackleaf Wildlife Management Area (T. 26 N., R. 8 W., Section 30). This site would require 1.25 miles of new road construction, starting from the end of the old road in Muddy Creek Canyon. The drill pad would be 2-4 acres in size. Any needed pipeline would run northeast 1.0 mile (outside of the access road) to the pipeline junction in Section 20 and then on to the production facility at the 1-8 well.

Four step-out wells would be projected for the same structure extending north from the 1-13 well. These wells would be drilled between 1993 and 1994, and would be located in a series on the slope east of Volcano Reef. Access to these wells would require approximately 4.4 miles of new road and 4.5 miles of road reconstruction. The 4.4 miles of new road would require a number of switchbacks from either the bottom of Blackleaf Canyon up to the 5,900 foot contour on the south, or an equal number of switchbacks from South Fork Dupuyer Creek to the 5,600 foot contour on the north.

The road required would be built in segments from one drill site to the next and would not necessarily extend all the way through from canyon to canyon. The wellsite locations proceeding south to north would include:

S-5 T. 26 N. R. 9 W., Section 12, SE¼
S-6 T. 26 N. R. 9 W., Section 1, SW¼
S-7 T. 26 N. R. 9 W., Section 2, NE¼
S-8 T. 27 N. R. 9 W., Section 35, SE¼

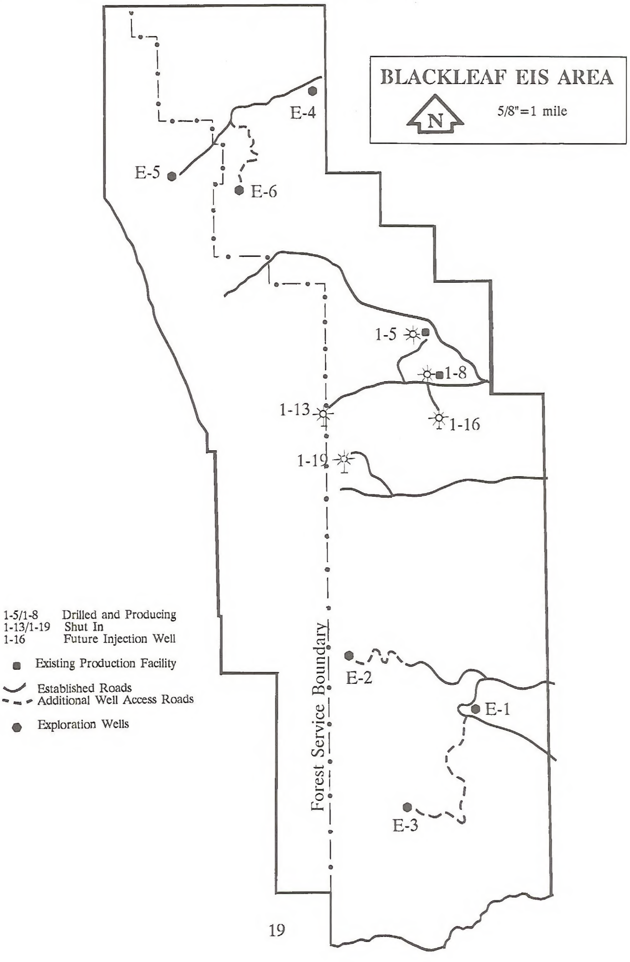
All drill sites would be located on the Lewis and Clark National Forest and would be 2-5 acres in size. Any needed pipelines would follow the access road as closely as possible either north to the South Fork Dupuyer Creek or south to Blackleaf Canyon.

Because each of these step-out wellsites would have production facilities on site, condensate would be stored in tanks at each location. The gas produced from each wellsite would be metered prior to being placed in the pipeline. For this reason, BLM is assuming the gas produced from the B-1, 1-19, S-1, S-2, and S-4 wells would be placed in a single, common pipeline (T. 26 N., R. 8 W., Section 20, SW¼SE¼). This pipeline would run north approximately 15 miles to the 1-8 wellsite where it would be placed in the pipeline running to the Gypsy Highview Plant. The gas from the S-3 well would be placed in the B-1 pipeline.

The gas from the S-5 well would be placed in the pipeline running from the 1-13 well to the 1-8 location, the gas from S-6 well would be placed in the S-5 pipeline. Gas from the S-7 well would be placed in the S-8 pipeline which runs to the 1-8 location. These four wells would require 7.65 miles of pipeline.

The exploration wells in this alternative are shown on Figures 2.5 and 2.6. Table 2.3 details the road construction/reconstruction portion of this alternative.

Figure 2.6 Alternative Two Schematic with Exploration Wells.



Alternative 2 includes three wells on the south end of the unit, in an area thought to have moderate potential for natural gas. The first well, (E-1), would be located about 0.5 mile east of the Burfening (Newman) Ranch near the road junction on private land (T. 25 N., R. 8 W., Section 9, SE¼). As this site would be located adjacent to an existing road, only 0.1 mile of new road construction would be required. The drill pad would be 3-5 acres in size.

The E-2 exploration wellsite would be located in Blind Horse Outstanding Natural Area (T. 25 N., R. 8 W., Section 6, SW¼). Although adjacent to an existing road, the road gradient is too steep for oil field traffic and would have to be rebuilt to specifications. This would entail a number of switchbacks up the slope and 2.8 miles of new road construction combined with 1.9 miles of existing road. The wellsite would be 3-5 acres in size.

The E-3 wellsite would be located in T. 25 N., R. 8 W., Section 20, NW¼. This site would require reconstructing about 1.1 miles of existing road and approximately 2.8 miles of new road. The drill site, 3-5 acres in size, would be on private land near the BLM property line.

Three exploration wells would be projected on the north end of the area. The E-4 well (T. 27 N., R. 9 W., Section 13, NE¼) would be adjacent to an existing road which may require 1 mile of reconstruction to the county road in Section 8. This 3-5 acre wellsite would be located on private surface.

The E-5 wellsite would be located near the terminus of the road in the North Fork of Dupuyer Creek (T. 27 N., R. 9 W., Section 27, NW¼). This 3-5 acre wellsite would be accessed by using 0.25 mile of new road, 3.3 miles of road reconstruction and 0.8 mile of existing road.

The E-6 well would be located in the Middle Fork Dupuyer Creek drainage (T. 27 N., R. 9 W., Section 26, NW¼). It would be located on an existing primitive road that would need widening and reconstruction for 2.0 miles. However, the current road route of 4.6 miles would be maintained. All the exploration wells would probably be drilled in 1994-1998.

Alternative 3 — Resource Protection

This alternative would favor the protection of wildlife, visual resources, air and water quality and other surface resources while allowing some development. This alternative would adhere strictly to the Interagency Rocky Mountain Front Wildlife Guidelines, which the agencies approved in 1984. These guidelines established measures for protecting important species/habitats (primarily for grizzly bears, mountain goat, bighorn sheep, elk, mule deer and raptors) by controlling human activity during critical portions of the year.

Other resources such as scenery, air and water quality, would be protected by using special design and construction techniques, advanced technology and special protective stipulations.

With this alternative, production facilities would be located offsite at a central facility on private surface over private minerals.

Gas plant construction, remote monitoring and powerline needs would be the same as those discussed in Alternative 1.

The following outline lists the activities included in this alternative:

Alternative 3 Outline

Existing producing wells	2
Existing Shut-in wells brought on line	2
Proposed Injection well	1
Proposed Step out wells	2
Proposed Exploration wells	2
Total wells	9
Proposed Gas processing facility	1
Total road miles in use	21.0*
Total new road construction	1.35
New pipeline not adjacent to the well access road	11.4 miles
New pipeline adjacent to the well access road	3.1 miles
Existing Pipelines	3.25 miles
Total Pipeline Miles	17.75
Timeframes	
Active drilling program	3-4 years (1991-1994)
Well field maintenance	30-40 years (1983-2017)
Wellsite abandonment and rehabilitation	Last 2 years of field life (2020-2022)

*The total road miles figure reflects counting some segments of the total road system multiple times since some segments would be used to access multiple wells. This was done to give the reader the total length of road to be used for each wellsite.

Alternative Description

All of the activities discussed in this alternative are shown on Figures 2.7 and 2.8 and Table 2.4 addresses road management. Those well access routes that are not currently part of the public access system would be closed to public use. Existing arterial and collector routes would remain open to public use to maintain public access (see Figure 2.9).

Due to the overlapping wildlife ranges along the Rocky Mountain Front, strict adherence to the Rocky Mountain Front Wildlife Guidelines (RMFWG) would eliminate long-term activity on 58 percent of the EIS area (Segment A of Figure 2.7). This land coincides with a portion of the most prominent potential oil and gas bearing structures. Thus the westernmost structure, containing the 1-13 and 1-19 wells, would not be developed to its optimum capacity.

TABLE 2.4

ROAD MANAGEMENT ALTERNATIVE 3[1]

	Additional Road Work Required			Total Road System to Nearest Maintained Public System			
Wellsite	Construction (Miles)	Reconstruction (Miles)	Total Construction and Reconstruction (Miles)	Roads Open to Public Use (Miles)	Roads Closed to Public Use (Miles)	Access Roads to be Reclaimed (Miles)	Period (Years)
1-13	0.00	0.00	0.00	3.95	0.00	0.00	1983-2025
1-19	0.00	0.00	0.00	0.40	4.20[2]	0.00	1983-2020
1-5	0.00	0.00	0.00	3.40	0.00	0.00	1990-2029
1-8	0.00	0.00	0.00	2.25	0.00	0.00	1990-2025
S-1	0.00	0.00	0.00	0.40	1.10	0.00	1990-2022
S-2	1.25	0.75	2.00	0.00	2.00	1.25	1990-2026
E-1	0.10	0.00	0.00	0.00	0.10	0.10	1994-2023
E-4	0.00	1.00	1.00	1.00	0.00	0.00	1996-2028
1-16	0.00	0.00	0.00	0.00	0.00	0.00	
Totals	1.35	1.75	3.0	14.4	7.4	1.35	

[1]BLM & USFS, 1989.

[2]From December 1 to June 30 the entire road is closed to the public via a MDFWP seasonal closure. That portion of the road that accesses only the wellsite is closed to the public year-round.

In accordance with Onshore Order No. 1, the two existing gas wells capable of production, but currently shut-in because they lack pipelines (1-13, 1-19) would be brought on line as discussed in Alternative 1.

All wells would require remote monitoring from the gas processing facility described in Alternative 1. However, further exploratory drilling in this area (Segment A of Figure 2.7) would be prohibited due to the prescribed timing windows required by the Rocky Mountain Front Wildlife Guidelines (Figure 2.10 illustrates these timing restrictions).

Another portion of the EIS area (Segment B of Figure 2.7) would have a late summer to late fall period during which construction activity could occur. This period could range from as short as 3 months to as long as 4 months, depending on the site specific circumstances of each activity. This segment includes the foothills, swamps and other natural features important to wildlife, just east of the Rocky Mountain Front (RMF) itself. This segment amounts to 32 percent of the Blackleaf EIS area.

Activities in the remaining portion of the EIS area (Segment C of Figure 2.7) would not be restricted by timing windows. The methodology used to define these segments is described in Appendix F.

Four step-out and exploratory wells would be projected in this alternative scenario.

The S-1 well, located 0.5 mile north of Antelope Butte Swamp, (T. 26 N., R. 8 W., Section 21), would be the final step-out well for the small gas structure associated with the 1-5 and 1-8 wells. This site is within the 3-month timing zone and would probably be drilled in 1991-92. About 1.5 miles of an existing road would be used to access the wellsite. The drill pad would be 3-4 acres in size.

Should the S-1 well be capable of commercial production, an 0.8-mile pipeline would be constructed adjacent to the road, west to the junction with the 1-19 pipeline, then north 2.5 miles to the central gas processing facility. This pipeline would utilize the same right-of-way as the 1-19 well from its junction in Section 21, north to the processing plant. All production facilities would be located at this site and would be designed to be compatible with visual resource management goals. Specifically, this would include designing the site to fit the natural setting, irregular boundaries, painting of the facilities to blend with their backdrop and prompt rehabilitation of disturbed areas.

Figure 2.7 Alternative Three.

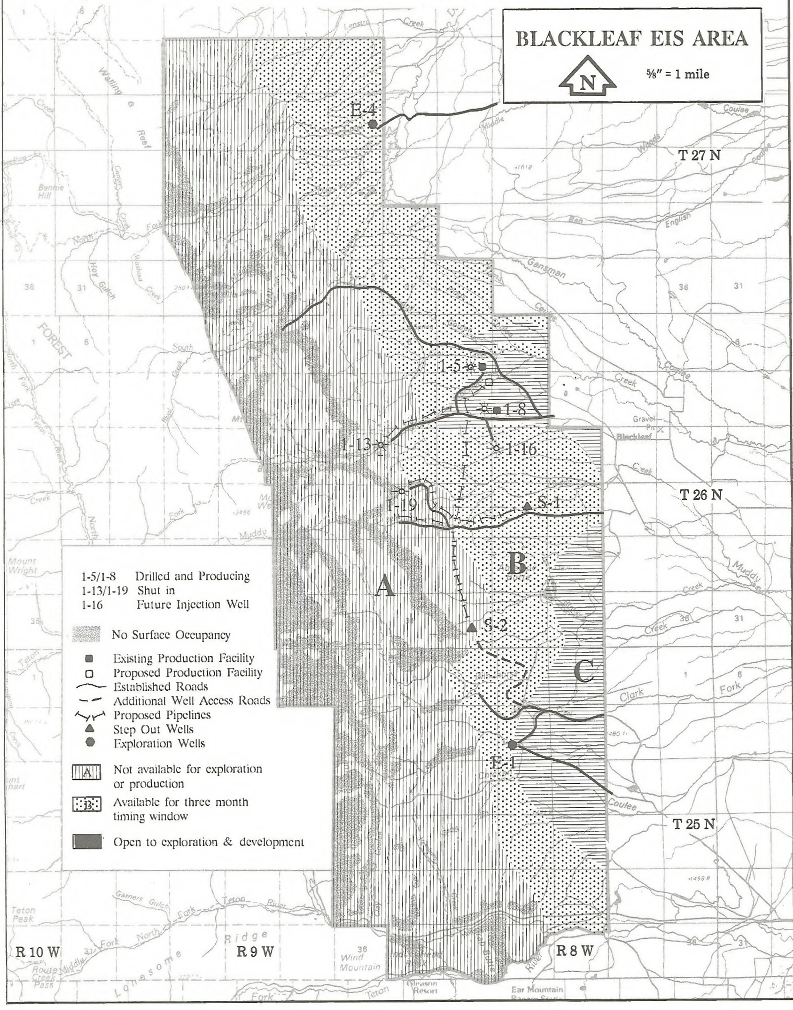


Figure 2.8 Alternative Three Schematic with Step Out and Exploration Wells.

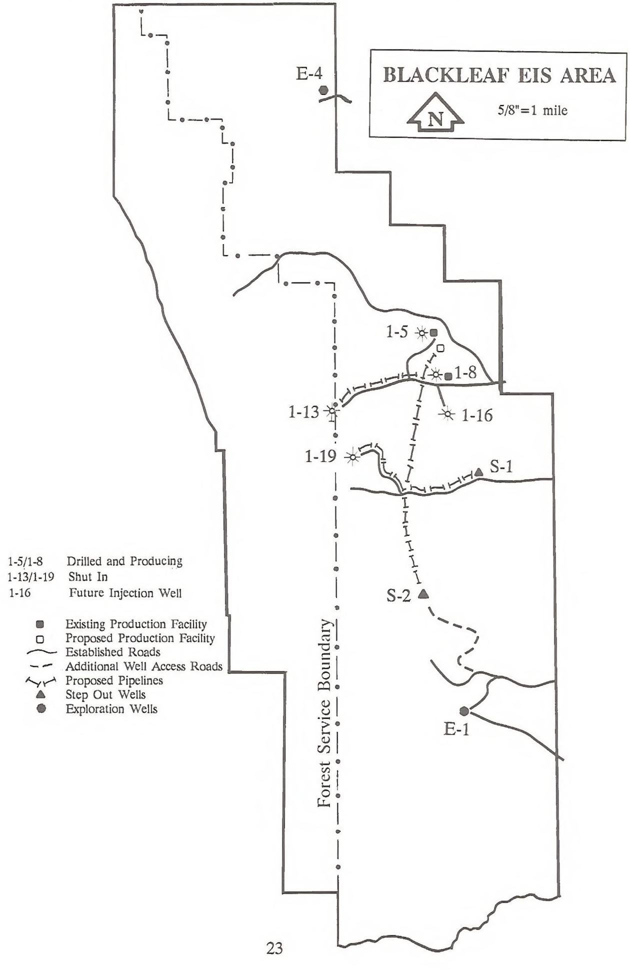


Figure 2.9 Access Routes in Alternative Three.

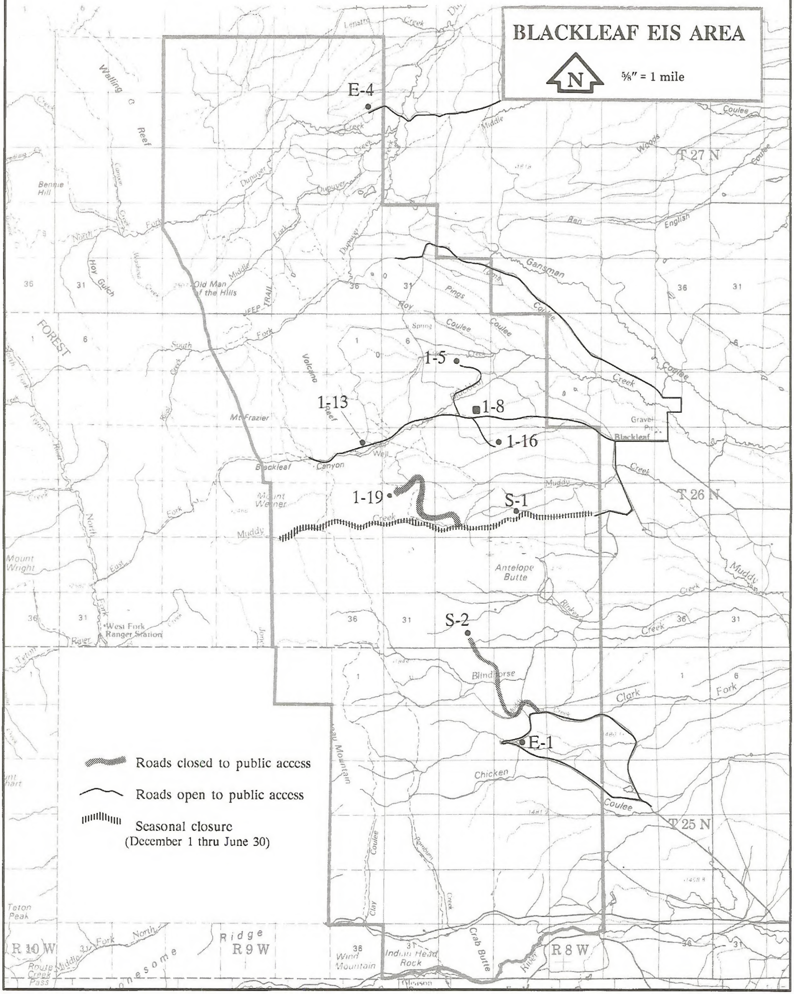
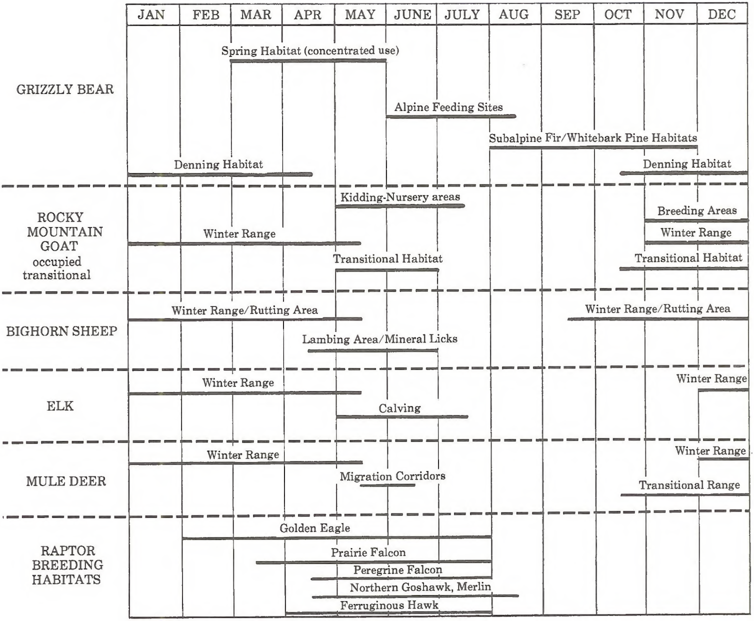


Figure 2.10 Species Specific Timing Restrictions for Human Activities.



The S-2 wellsite would be in the westernmost gas structure being served by the 1-13 and 1-19 wells. This well would be located in T. 26 N., R. 8 W., Section 32 and would require 1.25 miles of new road construction and 0.75 mile of road reconstruction. The drill pad would be 3-5 acres in size. If the well produces, a 1.8-mile pipeline would run north cross country from the wellsite to the junction with the 1-19 pipeline in Section 20, then north 2.4 miles along the existing pipeline right-of-way to the gas plant. The anticipated time frames for drilling this well would be 1993-1994.

The E-4 drill site would be located in the northeastern corner of the area in the 3-month activity zone (T. 27 N., R. 9 W., Section 13) along an existing road which may need some minor reconstruction. This drilling would likely be done between 1991-1992 and would require a 3-4 acre drill pad.

The E-1 drill site would be located in an open activity zone (no timing restrictions) in the southern portion of the area (T. 25 N., R. 8 W., Section 9) next to an existing road. No surface disturbance, other than the 3-5 acre drill pad and 0.1 mile of road access, would be necessary. Drilling would likely occur 1992-1994.

Alternative 4 — Preferred Alternative

This alternative represents the agencies' preferred scenario for oil and gas development within the Blackleaf EIS area. It combines elements of Alternative 2 (allowing maximum oil and gas field development) with Alternative 3 (following the Interagency Rocky Mountain Front Wildlife Guidelines for development along the Rocky Mountain Front).

This alternative best meets the requirements of law and regulation. Oil and gas leaseholders would be allowed to develop their lease while minimizing, to the extent possible, the adverse impacts to natural resources.

When strictly enforced, the RMFWG do not allow sufficient time to drill a well along the RMF. Because they are guidelines and not stipulations, the agencies have the ability to be flexible when applying these guidelines. Past experience indicates a typical well along the RMF requires 105 days to complete. Based on wildlife resource inventories and past studies, the fewest impacts to the greatest number of wildlife species occurs between July 15 and December 15. Therefore, this alternative requires an appropriate 105 day drilling period between July 15 and December 15. The 105 day window would be selected based upon the site specific wildlife resources impacted at each wellsite.

For example, a timing window selected to mitigate impacts to high value fall grizzly bear berry foraging areas (berries ripen through August) would probably be from September 1 to December 15. High density mule deer winter range (30 deer/square mile) would require a July 15-October 30th timing window.

If drilling activities could be completed with a short extension of time, an analysis of the site, and climatic and seasonal conditions could be made by the appropriate agencies. A short time extension could be granted on a case-by-case basis, if it would create a minimal or a significant lessening of impacts to wildlife, rather than requiring the company to stop and reenter the site the following year. Informal consultation with the USFWS would be undertaken if there would be a possibility that a T&E species would be impacted.

The July 15 to December 15 time period applies only to those areas shaded on Figure 2.11. The areas not shaded have the least restrictions due to wildlife habitat and could sustain year round drilling activities

Concurrent development activities in critical areas must be separated by at least a major drainage or a minimum distance of 1 mile at the agencies discretion, based on site specific location, resources and topography.

Production facilities would be located offsite at a central facility on private surface over private minerals.

Gas plant construction, remote monitoring and powerline needs would be the same as those discussed in Alternative 1.

The following outline lists the activities included in this alternative:

Alternative 4 Outline

Existing Producing wells	2
Existing Shut-in wells brought on line	2
Proposed Injection wells	1
Proposed Step out wells	7
Proposed Exploration wells	6
Total wells	18
Proposed Gas processing facility	1
Total road miles in use	63.45*
Total new road construction	12.25
New pipeline not adjacent to the well access roads	23.9 miles
New pipeline adjacent to the well access roads	12.65 miles
Existing pipeline	3.25 miles
Total pipeline miles	39.8**
Timeframes	
Active drilling program	1991-1999
Well field maintenance	1983-2025
Wellsite abandonment and rehabilitation	2023-2025 (last 2 years of field life)

*The total road miles figure reflects counting some segments of the total road system multiple times since some segments would be used to access multiple wells. This was done to give the reader the total length of road to be used for each wellsite.

**The reason for the high number of pipeline miles is that each well is metered at the gas plant after the gas and condensate are separated. Because the gas and condensate are shipped in the same line, a separate line for each well would be required. Many of these pipelines will be laid in the same right-of-way. Please refer to alternative discussion.

Alternative Description

Many of the site locations for roads, pipelines and wellsites in this alternative are the same as those found in Alternative 2. For the reader's convenience, those descriptions are repeated here, with specific changes proposed to mitigate resource impacts.

Under this alternative, step-out wells S-6 and S-7 were dropped. Preliminary informal discussions with the USFWS as well as potential impacts to habitat effectiveness shown by the Cumulative Effects Model (CEM) indicates these wells would significantly impact T&E species (see Appendix G).

The two producing gas wells, 1-5 and 1-8, would remain active; however, the storage facilities would be removed and the gas piped to a central gas processing facility located on private surface over federal minerals (T. 26 N., R. 8 W. Section 8, NE¼). The gas processing plant would not be a federal action and requires no federal approval. Each of these two sites would be partially rehabilitated and reseeded with native vegetation. The only facilities remaining at each of these two wellsites would be a wellhead and separation equipment contained inside a small building. There would be no new gas pipelines from either of these sites to the gas processing facility, as these pipelines already exist. The gas processing facility would be constructed approximately where these two pipelines join.

In accordance with Onshore Order Number 1, the two existing gas wells capable of production, but shut-in because they lack pipelines (1-13 and 1-19) would be brought on line as discussed in Alternative 1.

All gas produced by these wells would be processed at the central gas processing facility. The produced water would be disposed of as discussed in the Introduction section. The gas would then be piped east through existing pipelines where it would be routed around the Gypsy Highview Plant to eventually tie into a Montana Power Pipeline for delivery to commercial markets.

Remote monitoring would require electricity at each site. Powerlines would be a combination of above ground and underground lines (based on a case-by-case analysis of visual resource quality and other resource objectives). All powerlines would be built adjacent to roads and/or pipelines.

Step-out wells would be the first priority in this alternative.

All the step-out wells in this alternative are shown on Figures 2.11 and 2.12. and Table 2.5 describes the road management portion of this alternative. Those well access routes not currently part of the public access system would be closed to public use. Existing arterial and collector routes in the area would remain open to public use to maintain public access (see Figure 2.13).

The easternmost geologic structure, currently served by the 1-8 and 1-5 wells would be further defined by drilling the S-1 well 0.5 mile due north of the Antelope Butte Swamp (T. 26 N., R. 8 W., Section 21). This is the only well proposed for this field as the addition of the one well should sufficiently drain this reservoir.

The S-1 wellsite would be located adjacent to an existing road, of which 1.5 miles would be upgraded, but no new road construction or reconstruction would be needed. The drill pad would be 3-4 acres in size. If this well is a producer, a 3.3-mile pipeline would be constructed from this wellsite to the gas processing plant. Of this 3.3 miles, 0.8 mile would be adjacent to the access road and 2.5 miles would be new disturbance. It's assumed this well would be drilled in mid 1992.

The westernmost field, served by the 1-13 and 1-19 wells, would have as many as six step-out wells ranging north and south of the existing wells. The first priority would be to reenter the B-1 well located in T. 26 N., R. 8 W., Section 19, NE¼SW¼. This well was originally drilled in 1958, and produced approximately 900-1,000 MCF of gas per day. At that time there was no market for natural gas and the well was shut-in until 1973, when the well was plugged and abandoned and the site restored. At today's prices this well is commercially viable. The site lies in the bottom and at the mouth of Muddy Creek Canyon the Blackleaf Wildlife Management Area.

Drilling the B-1 well would entail reentering the old drill hole and completing it as a producer. The old existing road (3.7 miles) would require minor reconstruction, but no new construction. The drill pad should be small (1-2 acres) and the time on site should be 30 days or less. Once completed, separation facilities would be installed and a 0.9-mile pipeline constructed down Muddy Creek, then north 0.5 mile to the junction with the 1-19 pipeline, then north 2.3 miles to the gas processing plant. The last 2.3 miles would be laid beside the 1-19 pipeline. It's anticipated this action would occur in the first year of operation and run concurrently with the 1-13 and 1-19 well activities.

During the second and third years of operation (1992-93), the western and southern limits of the field would be tested with two step-out wells (S-2 and S-3). The first of these wells to be drilled would be S-3 (T. 26 N., R. 9 W., Section 24, SE¼), which would test the western extent of the field.

The S-3 site would require about 0.25-0.5 mile of new road construction, 0.2 mile of road reconstruction from the B-1 wellsite and approximately 3.5 miles of existing road. Any pipeline needed for this well would parallel the access road (0.65 mile to the junction with the B-1 well pipeline) then parallel the B-1 pipeline 3.3 miles to the gas plant.

The southern limits of the structure would be explored with the S-2 well on the divide between Rinker and Blind Horse Creeks (T. 26 N., R. 8 W., Section 32). Access would involve using an existing road along the Clark Fork of Muddy Creek 1.9 miles to a point in the SE¼SW¼ of Section 5, T. 26 N., R. 8 W., then constructing 2.4 miles of new road across Blind Horse Creek to the wellsite. The drill pad would be 3-5 acres in size. If the well produces, a pipeline would run east approximately 2.4 miles (east of Antelope Butte), then north-northwest approximately 2.0 miles to the S-1 wellsite. The pipeline would then follow an access road west approximately 0.8 mile, then north 2.5 miles to parallel the 1-19, B-1, S-1, S-3, and S-4 pipelines to the gas processing plant.

TABLE 2.5

ROAD MANAGEMENT
ALTERNATIVE 4[1]

	Additional Road Work Required			Total Road System to Nearest Maintained Public System			
Wellsite	Construction (Miles)	Reconstruction (Miles)	Total Construction and Reconstruction (Miles)	Roads Open to Public Use (Miles)	Roads Closed to Public Use (Miles)	Access Roads to be Reclaimed (Miles)	Period (Years)
1-13	0.00	0.00	0.00	3.75	0.00	1.50	1983-2025
1-19	0.00	0.00	0.00	0.40	4.20[2]	2.00	1983-2020
1-5	0.00	0.00	0.00	3.40	0.00	0.90	1990-2029
1-8	0.00	0.00	0.00	2.25	0.00	0.00	1990-2025
S-1	0.00	0.00	0.00	0.40	1.10	0.00	1990-2022
S-2	2.40	0.00	2.40	1.30	3.00	2.40	1990-2026
S-3	0.25	0.20	0.45	0.40	3.60	0.25	1992-2017
S-4	1.00	0.00	1.00	0.40	4.60	1.00	1992-2027
S-5	2.90	0.00	2.90	3.25	3.10	2.90	1993-2024
S-8	0.00	3.80	3.80	3.50	0.30	0.30	1994-2021
B-1	0.00	0.00	0.00	0.40	3.30	1.10	1991-2025
1-16	0.00	0.00	0.00	0.00	0.00	0.00	
E-1	0.10	0.00	0.00	0.00	0.10	0.10	1994-2023
E-2	2.80	0.00	2.80	1.30	3.40	2.80	1995-2027
E-3	2.80	1.10	3.90	0.00	3.90	3.90	1995-2027
E-4	0.00	1.00	1.00	1.00	0.00	0.00	1996-2028
E-5	0.00	3.30	3.30	3.00	1.10	1.10	1997-2029
E-6	0.00	2.00	2.00	2.60	2.00	2.00	1998-2030
Totals	12.25	11.4	23.55	27.55	33.7	22.25	

[1]BLM & USFS, 1989.

[2]From December 1 to June 30 the entire road is closed to the public via a MDFWP seaonal closure. That portion of the road that accesses only the wellsite is closed to the public year-round.

The last step-out well for the southern portion of this structure (S-4) would be located on the MDFWP Blackleaf Wildlife Management Area (T. 26 N., R. 8 W., Section 30). The road to this location would require utilizing 4.0 miles of existing road and constructing 1.0 mile of new road beginning at the end of the old road in Muddy Creek Canyon. The drill pad size would be 2-4 acres. Any needed pipeline would run from this site back down the access road 2.0 miles to the line coming from the S-3 and B-1 wells in the NW¼ of Section 20, then north 2.3 miles, paralleling the S-3 and B-1 pipelines to the gas plant.

The S-5 and S-8 wells would be projected for the same structure extending north from the 1-13 well for the fifth through the eighth year of development. These wells would be located on the slope east of Volcano Reef. To avoid disturbance to wildlife habitat in the sensitive area below Volcano Reef, no loop roads would be allowed.

The S-5 would be the first well drilled (T. 26 N., R. 9 W., Section 12). The access road would involve 2.9 miles of switchbacks heading north from the end of the existing road in Blackleaf Canyon, then join 3.45 miles of existing road. Any necessary pipeline would head northeast to the end of the first switchback, then south along the access road to the bottom of Blackleaf Canyon. It would then turn east and follow existing road 1.1 miles, where it would leave the access road and continue 1.2 miles to the gas plant. The total pipeline length would be 3.3 miles.

Should S-5 be a producing well, S-8 would be the next site drilled (T. 27 N., R. 9 W., Section 35). The access road would follow a county road from a point in Section 13, T. 26 N., R. 7 W. northwest to a point in Section 33, T. 27 N., R. 7 W. then continue west 3.8 miles to the wellsite. This road would require minor reconstruction. Any needed pipeline would follow the same general route as shown in Alternative 2. The total pipeline length would be 4.0 miles, of which 3.2 miles would be adjacent to the existing access road.

A central gas processing facility and remote monitoring would be required for these wells. The central facility would require each well to have its own pipeline. For this reason, the miles of pipeline are higher under this alternative than Alternative 2. However, many of the pipelines (1-19, B-1, S-1, S-2, S-3, S-4) would be placed beside each other in the same trench (from T. 26 N., R. 8 W., Section 20 NE¼NW¼ north to the gas plant), thereby lessening surface disturbance.

The exploration wells in this alternative are shown on Figures 2.11 and 2.14.

The E-1 well would be drilled in the southern end of the unit, in an area thought to have moderate potential for natural gas. This well would be located about 0.5 mile east of the Burfening (Newman) Ranch near the road junction on private land (T. 25 N., R. 8 W., Section 9, SE¼. As this site would be located adjacent to an existing county maintained road, only 0.1 mile of road would be necessary to access the wellpad. No construction other than the 3-5 acre drill pad would be necessary.

Figure 2.11 Alternative Four.

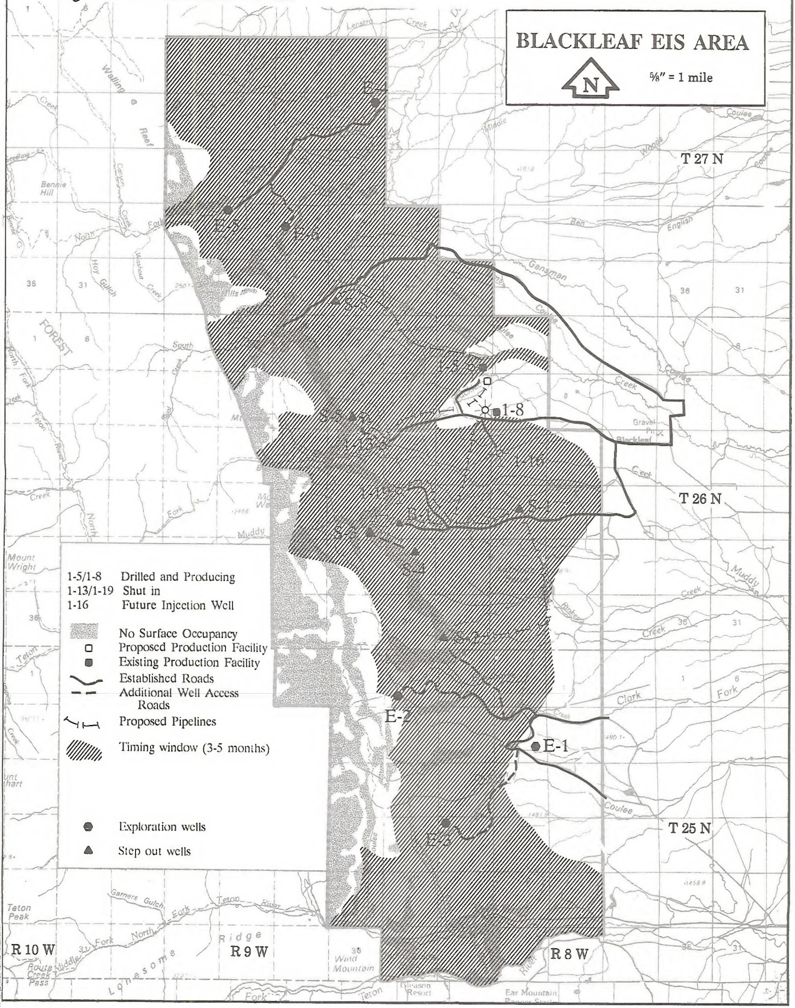


Figure 2.12 Alternative Four Schematic with Existing and Step Out Wells.

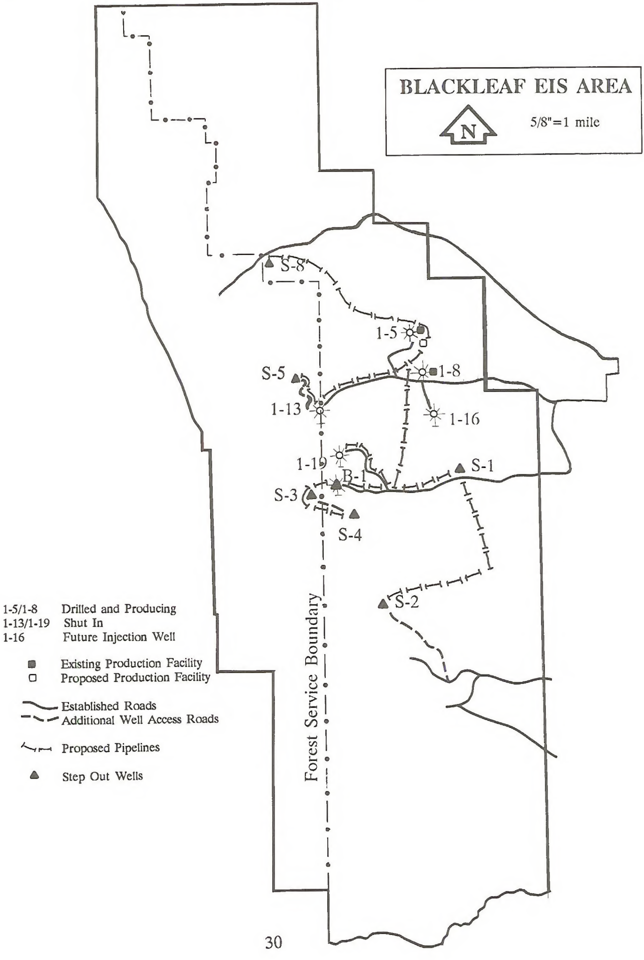


Figure 2.13 Access Routes in Alternative Four.

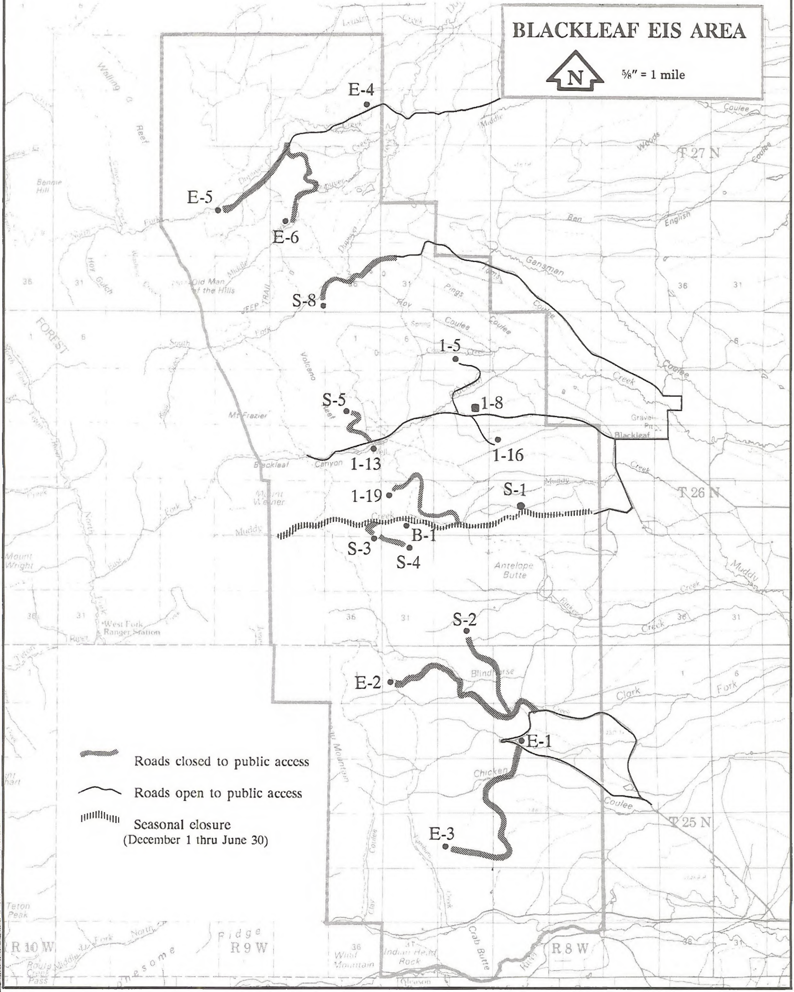
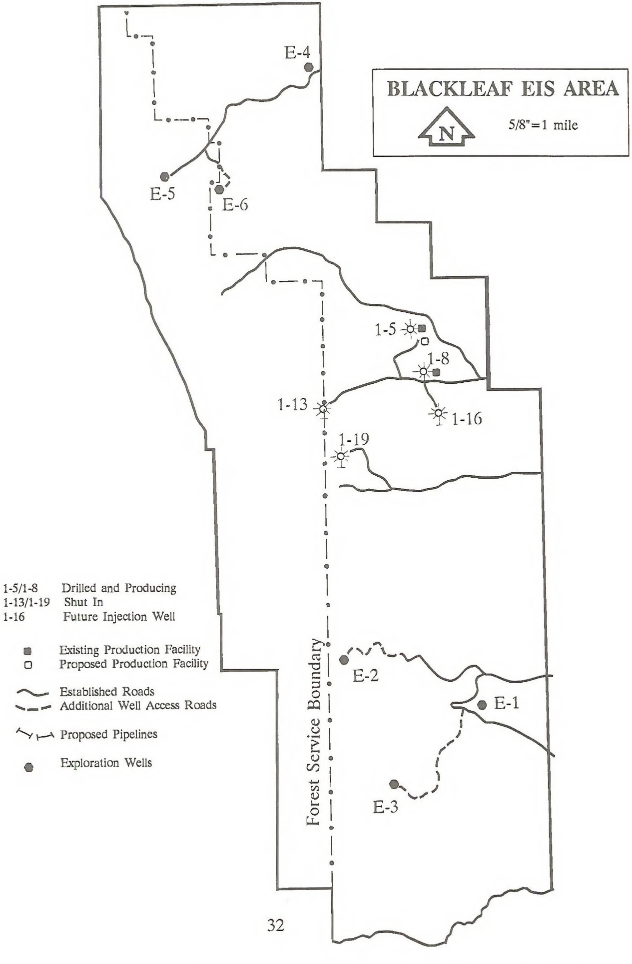


Figure 2.14 Alternative Four Schematic with Existing and Exploration Wells.



The E-2 wellsite would be within the BLM's Blind Horse Outstanding Natural Area (T. 25 N., R. 8 W., Section 6, SW¼). Although adjacent to an existing road, the road gradient is too steep for oil field traffic and would have to be rebuilt to specifications. This would entail a number of switchbacks up the slope and essentially means 2.8 miles of new road construction and 1.9 miles of an existing road to reach the E-1 wellsite. The old road would be rehabilitated. The wellsite would be 3-5 acres in size.

The E-3 well would be located in T. 25 N., R. 8 W., Section 20, NW¼. This site would require reconstructing about 1.1 miles of existing road and constructing approximately 2.8 miles of new road. The drill site, 3-5 acres in size, would be on private land near the BLM property line. It's anticipated these exploration wells would be drilled between 2000-2002.

Three exploration wells would also be assumed for the north end of the area. One of these would be the E-4 (T. 27 N., R. 9 W., Section 13, NE¼). This wellsite would be located adjacent to an existing road which may require 1.0 mile of reconstruction to the county road in Section 8. This would be a 3-5 acre wellsite. Another wellsite (E-5) would be located near the terminus of the road in the North Fork of Dupuyer Creek (T. 27 N., R. 9 W., Section 27, NW¼). A short (less than 0.25 mile) spur road may be built to the 3-5 acre wellsite. Approximately 3.3 miles of the existing 4.1 miles of road would need reconstruction.

The last exploration well (E-6) would be in the northern portion of the EIS area in the Middle Fork Dupuyer Creek drainage (T. 27 N., R. 9 W., Section 26, NW¼). It would be located on an existing primitive road that would need widening and reconstruction for 2.0 miles of the 4.6 miles of existing road. It's assumed E-4, E-5 and E-6 could be drilled in 1998-2000.

COMPARISON OF ALTERNATIVES

Table 2.6 compares development activities among the alternatives. This table summarizes the information given in this chapter.

Table 2.7 compares the environmental consequences expected for each alternative. This table is based on information presented in Chapter 4, but is included here for the reader's convenience.

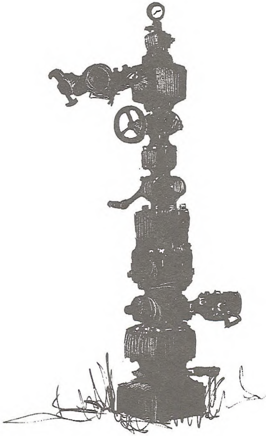


TABLE 2.6
ALTERNATIVE SUMMARY TABLE

	1	2	3	4
Baseline	Two producing gas wells with production facilities. Two shut-in gas wells. One temporarily abandoned well. 3.25 miles of existing pipeline.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.
Allowable Development	Two shut-in gas wells brought on line. Two new pipelines totalling 5.2 miles. Conversion of one temporarily abandoned well to water injection well. Disband two condensate storage facilities and construct one gas processing plant for all wells. Separation/dehydration facilities at each site.	Two shut-in gas wells brought on line. Two new pipelines totalling 5.2 miles. Conversion of one temporarily abandoned well to water injection well. Two new condensate storage facilities located at the well sites brought on line. Separation/dehydration facilities at each site.	Same as Alternative 1.	Same as Alternative 1.
Proposed New Development	None	Nine step out wells located throughout the EIS area with separation and production facilities located on site. Six exploration wells. 12.85 miles new road construction. 12.85 miles road reconstruction 11.1 miles new pipeline adjacent to access road. 7.6 miles new pipeline outside access road.	Two step-out wells with only separation/ dehydration facilities located on site. Two exploration wells. 1.35 miles new road construction. 1.75 miles road reconstruction. 3.1 miles new pipeline adjacent to access road. 11.4 miles new pipeline outside access road.	Seven step out wells with only dehydration/ separation facilities located on site. Six exploration wells. 12.25 miles new road construction. 11.4 miles road reconstruction. 12.65 miles new pipeline adjacent to access road. 23.9 miles new pipeline outside access road.

Source: BLM 1989

TABLE 2.7
IMPACT SUMMARY TABLE

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Air Quality	No impacts from the central gas plant because it is a "closed system" process. Due to gas plant construction, nuisance odors at existing wellsites would be minimal.	Short term impacts during drilling operations. Increased impacts (moderate) due to production facilities at each wellsite, due to increased escape of fugitive gases at wellhead and production facilities.	Minor short term impacts during drilling. No impacts from "closed system" gas processing plant. Nuisance odors at existing wellsites would be minimal.	Minor, short term impacts during drilling as the drill rig operates. No impacts from "closed system" gas processing plant. Nuisance odors at existing wellsites would be minimal.
Paleontology	Pipeline construction may disturb the context in which fossils are found. Overall effect may be positive because of possible new discoveries and new knowledge. May be minor negative impact by loss of fossils to collectors and rock hounds.	Same as Alternative 1, but on a larger scale because of the increased number of wellsites. One type of significant fossil (dinosaur remains) could be impacted by E-4.	Similar to Alternative 2, but on a smaller scale because of fewer wells. E-4 well could impact dinosaur remains.	Similar to Alternative 2.
Cultural Resources	Minimal impact - all actions proposed for localities previously disturbed. 25 acres disturbed.	199 acres disturbed by construction activities, improved access/people could increase looting.	102 acres disturbed by construction activities, improved access/people could increase looting.	289 acres disturbed by construction activities, improved access/people could increase looting.
Soils	Impacts to 25 acres of soil types with low soil stability hazards. Impacts to approximately 9 acres having moderate soil stability.	Approximately 61 acres of soil having low soil stability hazards will be affected. Approximately 120 acres of soil having moderate soil stability hazards will be affected.	Approximately 26 acres of soil characterized by moderate soil stability hazards would be affected. Approximately 30 impacted acres would have low soil stability hazards.	Approximately 60 acres of soil characterized by low soil stability hazards will be affected. Approximately 122 acres having moderate soil stability hazards will be affected.
Vegetation	Approximately 24 acres of forested area (including 7 acres dense coniferous forest, and 2 acres aspen-cottonwood forest) would be disturbed. 9 acres of grassland would be disturbed reducing forage potential by about 4,500 lbs. total forage/year. 34 acres would be susceptible to noxious weed infestation.	Approximately 140 acres of forested area would be disturbed including 89 acres dense conferous forest, 28 acres of aspen-cottonwood forest). 36 acres of grassland vegetation would be disturbed, reducing forage potential by 18,500 lbs. 2.5 acres gravel bar affected. 182 acres disturbed susceptible to noxious weed infestation.	Approximately 38 acres of forested area would be disturbed (including 25 acres dense coniferous forest, 10 acres open coniferous forest, 3 acres aspen-cottonwood forest). 19 acres of grassland vegetation would be disturbed reducing forage potential by 9,800 lbs. forage/year. 57 acres disturbed susceptible to noxious weed infestation.	Approximately 149 acres of forested area would be disturbed (including 86 acres of dense coniferous forest, 47 acres of open coniferous, 16 acres of aspen-cottonwood forest). 29 acres of grassland vegetation would be disturbed reducing forage potential by 15,500 lbs. forage/year. 6 acres gravel bar would be affected. 184 acres disturbed would be susceptible to noxious weed infestation.
Livestock	20 acres of forage in 1 allotment would be disturbed resulting in 2.4 AUMs lost. Minor impacts to forage.	118 acres of forage in 4 allotments would be disturbed resulting in 12.8 AUMs lost. Low impacts to forage.	28.5 acres of forage in 3 allotments disturbed resulting in 3.4 AUMs lost. Minor impacts to forage.	96.5 acres of forage in 4 allotments disturbed resulting in 12.4 AUMs lost. Low impacts to forage.

TABLE 2.7 (continued)
IMPACT SUMMARY TABLE

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Fish & Wildlife				
(*Wildlife)				
Grizzly Bear —				
Spring Habitat	12,060 acres	38,020 acres	20,100 acres	38,020 acres
Denning Habitat		170 acres		170 acres
Rocky Mountain Goat —				
Occupied Yearlong	2,050 acres	8,390 acres	2,050 acres	7,680 acres
Breeding, Kidding, Nursery	2,050 acres	8,390 acres	2,160 acres	7,680 acres
Mineral Licks	-0- acres	*(5)	-0- acres	*(4)
Bighorn Sheep —				
Winter Range		530 acres		430 acres
Elk —				
Winter Range	12,060 acres	33,810 acres	17,810 acres	35,820 acres
Calving Area	920 acres	5,180 acres	1,000 acres	4,900 acres
Migration Routes	*(2)	*(4)	*(2)	*(4)
Mule Deer —				
Winter Range	5,410 acres	15,600 acres	13,150 acres	17,680 acres
Fall Transitional Range	400 acres	2,980 acres	400 acres	2,930 acres
Migration Routes	*(2)	*(3)	*(3)	*(3)
Raptors —				
Breeding/ Nesting Habitats	*(16)	*(78)	*(29)	*(73)
Fisheries	*(2)	*(9)	*(3)	*(8)
TOTAL	34,950 acres (22) habitat features	113,070 acres (99) habitat features	56,560 acres (37) habitat features	**117,420 acres (92) habitat features

*Each number represents one wellsite falling within 1-mile zone of influence of the habitat feature; e.e., 16 indicates that 16 raptor habitats are influenced by the wellsites programmed in Alternative 1.

**Even though more acres of habitat are influenced by Alternative 4 than by Alternative 2, the impacts to wildlife are significantly less in Alternative 4. Implementing remote monitoring requires a central gas processing facility and reinjection well which add to the acres of habitat influenced, but reduces the significance of the impacts at all sites.

TABLE 2.7 (continued)
IMPACT SUMMARY TABLE

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Geology	No impacts. No increase in subsurface geologic information.	No negative impacts. Drilling would increase subsurface geologic information.	Same as Alternative 2.	Same as Alternative 2.
Oil & Gas	23 of 25 leases not drilled/developed.	12 of 25 leases not drilled/ developed.	21 of 25 leases not drilled	13 of 25 leases not drilled/ developed.
	13.7 to 27.0 BCF of the estimated 110 to 284 BCF recoverable reserves would be produced.	17.8 to 105.6 BCF of the estimated 110 to 284 BCF or recoverable reserves would be produced.	13.7 to 44.9 BCF of the estimated 110 to 284 BCF of estimated reserves would be produced.	15.0 to 68.2 BCF of the estimated 110 to 284 BCF of recoverable reserves would be produced.
		100% of the EIS area open to drilling/development subject to lease stipulations, standard management practices.	10% of the EIS area open to drilling/development subject to lease stipulations, standard management management practices.	10% of the EIS area open to drilling/ development subject to lease stipulations, standard management practices.
			38% of the EIS area open to drilling/development subject to timing windows, lease stipulations and standard management practices.	90% of the EIS area open to drilling/development subject to timing windows, lease stipulations, standard management practices.
			52% of the EIS area closed to drilling/development due to overlapping timing windows.	
Surface Water	Minor increase in sedimentation due to surface disturbance.	Moderate possibility of increased sedimentation from increased surface disturbance.	Low probability of increased sedimentation.	Moderate possibility of increased sedimentation from surface disturbance erosion, but less than Alternative 2.
Groundwater	Minor impacts due to lowering of intercepted groundwater in pipeline trenches. No lasting effects. Temporary increase in turbidity and sediment would be a minor impact.	Minor impact during road and drill pad construction due to increased sedimentation. No lasting effect. Minimal possibility that drilling fluids would enter subsurface aquifers because of normal casing program. Minimal possibility of impacts from subsurface disposal of produced water. Geologic record is that very little salt water is expected to be produced. Temporary increase in turbidity and sediment would be a minor impact. Less infiltration and increased run off due to compaction.	Similar to but less than Alternative 2.	Similar to but less than Alternative 2.

TABLE 2.7 (continued)
IMPACT SUMMARY TABLE

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Recreation	Short-term impacts from pipeline and gas plant construction, noise and increased traffic.	Reduction of 80 acres from semi-primitive to roaded natural setting.	Impacts similar to Alternative 1.	Similar to Alternative 2.
		New roads/access could be viewed as a positive or negative impact.		
	Short-term limitation of access on U.S. Forest Service trail 106.	Could increase access for winter recreation.		
		USFS trails 106, 124, 153 would be easier to access, possibly lessening overall recreational experience.		
Visual	Dismantling the 1-8 and 1-5 facilities would improve the visual quality of the foreground and middle ground views - a positive impact.	Significant impacts from roads to E-2, S-2 and S-5 wellsites.	Short-term impacts frcm pipeline construction. Overall impacts similar to Alternative 1.	Overall moderate impacts with some localized significant impacts.
		Blind Horse ONA Class I VRM objective would be exceeded.		
	Short-term visual contrasts from pipeline construction.	Moderate impacts from road construction and wellsites at E-3, S-6 and S-7.		Overall impacts similar to Alternative 2.
		Moderate impact to foreground view from facilities at each wellsite.		
Noise	Short term increase in noise during pipeline and gas plant construction. No lasting effect. Noise impacts from the gas plant would be minimal and only noticeable within the immediate vicinity of the plant (1/4 - 1/2 mile).	Short term impacts during drilling and construction. Minor long term impacts from production noise at the wellsite and vehicular traffic to and from the wellsite by maintenance workers, tanker trucks hauling condensate, etc. Field development with facilities at each wellsite would cause long-term noise impacts, but they would not be significant.	Same as Alternative 1.	Same as Alternative 1.
		Increased drilling and access may impact wildlife migration routes.		
Transportation System	No impacts.	Possibilities of increased public vehicle use on road system, causing "washboarding", rutting, etc.	Similar to, but less than Alternative 2.	Impacts very similar to Alternative 2.

TABLE 2.7 (continued)
IMPACT SUMMARY TABLE

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Social & Economic	Negative impacts. Oil and gas industry able to develop 2 of 25 leases. Federal and state governments wouldn't receive annual leasing revenues of $17,000-$44,000 and $8,500-$22,000, respectively.	Population, employment, and income would have moderate, short-term increases in demand. Existing inventories of housing and community services are adequate for increased levels of demand. Insignificant, short-term adverse impacts to social well-being.	Impacts same as Alternatives 2 and 4 for population, employment, income, housing, facilities and services, public finance and social conditions.	Impacts same as Alternatives 2 and 3 for population, employment, income, housing, facilities and services, public finance and social conditions.

Source: BLM 1989

Chapter Three The Affected Environment

INTRODUCTION

This chapter describes the existing conditions, uses and resources that could be affected by any of the alternatives described in Chapter 2. Each resource or program discussed is keyed to the issue(s) it relates to, in order to provide the reader a more complete description of the environmental impact statement (EIS) area.

TOPOGRAPHY

(Issues: General, Visual Resources)

The Blackleaf EIS area is dominated by the Rocky Mountain Front (RMF) which rises 3,100 feet from the surrounding foothills and plains. The Front lies in the western portion of the EIS area and contains such notable topographic features as Choteau Mountain (8,216 ft.), Mount Werner (8,090 ft.), Mount Frazier (8,315 ft.), Old Man of the Hills (8,225 ft.) and a portion of Walling Reef. A number of deeply incised canyons cut through the area; the most notable being the North and South Forks of Dupuyer Creek, Blackleaf Canyon, Muddy Creek Canyon; and in the southern portion of the EIS area, the North and South Forks of the Teton River (see Figures 3.1 and 3.2).

Immediately east of the RMF the low foothills, rolling prairies and Antelope Butte dominate the topography. The majority of the creeks flow west to east through these plains. Other minor creeks include Cow Creek, Blind Horse Creek and Chicken Coulee which flow west to east. Pamburn Creek and Clary Coulee flow in a north-south direction and empty into the North Fork of the Teton River.

The easternmost portion of the EIS area is mostly rolling prairie with some small coulees.

CLIMATE

(Issues: General, Oil & Gas Operations)

The EIS area is characterized by relatively hot summers and cold winters with temperatures ranging from over 100 degrees Fahrenheit (F) in the summer to -35°F during the winter. The mean annual temperature of the area is 42.5°F. Winter can be severe and the ground normally freezes to a depth of approximately 36 inches.

Terrain is an important factor in the precipitation pattern in this area. The Continental Divide causes rain shadow effects along the east side of the Divide, resulting in precipitation averages of 30-40 inches at the higher elevations and 10-20 inches in the foothills and on the plains. Much of this precipitation falls as winter snow and/or spring rains. Snowfall depth will vary, based on elevation.

Wind is a major environmental factor for this area and wind speeds average 15 miles per hour with a prevailing east movement. Winter and spring chinook winds often raise the temperature 20 to 30°F in a matter of hours and can deplete much of the stored snow in the foothills and plains. Timber in the area is often wind pruned and sculptured by the prevailing winds.

AIR QUALITY

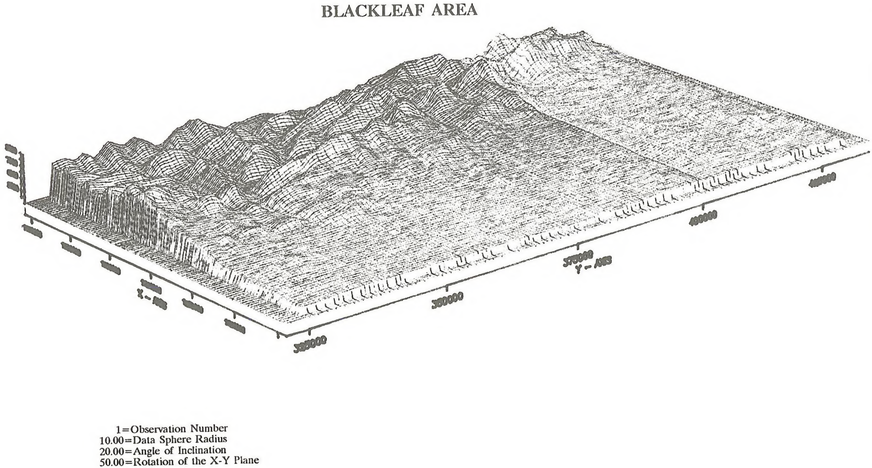
(Issue: Air Quality)

Air quality is excellent due to the presence of Class I air sheds directly upwind and the lack of pollutant sources in the EIS area. Upwind and west of the EIS area are the Great Bear and Bob Marshall Wilderness Areas which are Class I air quality areas. The EIS area is in a Class II air quality area established by the Clean Air Act Amendments of 1977 — Prevention of Significant Deterioration (PSD) Requirements.

A Class I air quality area is defined as any area which has the highest degree of protection from future degradation. The Clean Air Act designated each national park over 6,000 acres and each national wilderness area over 5,000 acres as Class I areas. A Class II area is any area cleaner than federal air quality standards and designated for a moderate degree of protection from future air quality degradation. Moderate increases in new pollution may be permitted in a Class II area. A Class III area is any area cleaner than federal air quality standards which is designated for a lesser degree of protection from future air quality degradation. Significant increases in new pollution may be permitted in Class III areas.

Low level emissions occur from the gas production facilities associated with the producing wells (1-5 and 1-8) described in Chapter 2. Hydrogen Sulfide (H_2S) and fugitive hydrocarbon gases are the most significant pollutants emitted. Hydrogen Sulfide and SO_2 are lethal at higher concentrations, (more than 1,000 parts per million (ppm)) and being heavier than air will flow downslope. For a complete discussion of H_2S (effects, characteristics and chance for a blow-out) please refer to Appendix H. Extremely low concentrations of these pollutants (0.01 ppm to 10 ppm) will create nuisance odors. Some minor H_2S leakage (less than 0.2 ppm) may occur around shut-in wells, old plugged and abandoned well holes, and on tanks not having vapor recovery apparatus. These emissions lie well within federal standards and do not threaten the requirements of the Class II area.

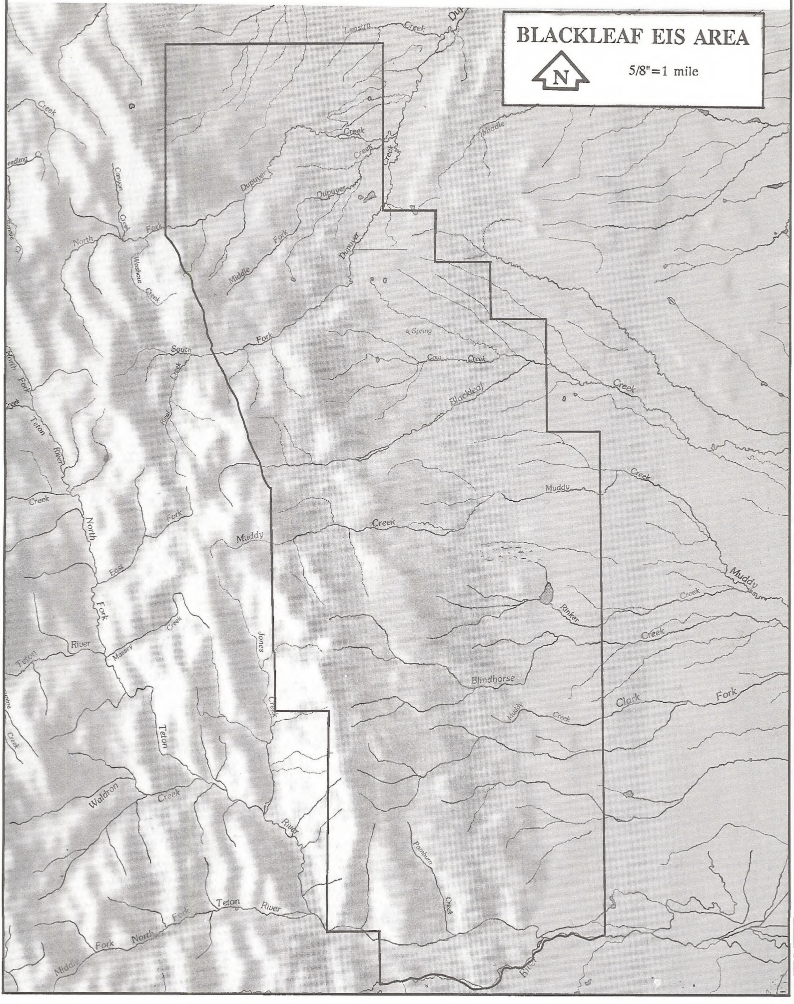
Daily emissions of H_2S typically measure less than 0.2 ppm immediately adjacent to the facilities, but may cause a sulfur odor. However, these amounts are unmeasurable by typical field monitoring equipment.



USDA, FOREST SERVICE

Figure 3.1 GIS Topography of the Blackleaf EIS Area.

Figure 3.2 Shaded Relief and Drainages of the Blackleaf EIS Area.



Hydrogen Sulfide monitoring by oil and gas operators and BLM personnel occurs routinely at wellsites and any measurable levels results in corrective action.

Dust from vehicle traffic on dirt roads in the summer causes short-term degradation, but is localized and sporadic in nature. Smoke from summer forest or range fires will occasionally infiltrate the region with smoke and wood smoke from the widely scattered ranch buildings may be visible on autumn or winter days.

PALEONTOLOGICAL RESOURCES

Paleontological resources consist of fossil plants and animals derived from past life on earth. The fossils discussed below are believed to be in the EIS area.

Brachiopods are marine animals whose soft parts are enclosed within a two-valved shell. They were first found in Cambrian time and are very abundant in the fossil record (Clarkson, 1979). They occur within the limestone and dolomite cliffs.

Corals are abundant in the geologic record and range from Cambrian to present time. They are found in the dolomite and limestone outcrops.

Belemnites are the internal shells of extinct squid-like animals, and have the appearance of a bullet and range from 2 to 4 inches in length. They are common in shales and sandstones and are similar to the shells of a modern squid or cuttlefish.

Pelecypods are bivalves with a shell consisting of a pair of calcareous valves between which soft parts of the body are enclosed. They are very abundant in the fossil record and are present in marine and fresh water environments today. They have existed since Ordovician time. Ammonites consist of a coiled up shell with a squid-like animal living within the shell. In some places along the Rocky Mountain Front they are common and are up to 1½ feet in diameter. They first appeared in the fossil record in the Cambrian period and became extinct in the late Cretaceous. Their modern day equivalent is the coiled nautilis.

Leaf fragments, petrified wood, organic burrows and trails are located in various shale beds and fine grained sandstones and are generally inconspicuous and hard to find.

Coquina consists of a mass of broken, abraded shell fragments which are cemented back together and can be found in the limestone cliffs.

Gastropods are snails and slugs living in the sea, fresh water and on land. They first appeared in the fossil record in the Cambrian and presently are more abundant than at any time in the past.

Scattered reptile (dinosaur) bones are present in various Cretaceous Age formations. The context in which these fossils are found is significant in establishing the social behavior of dinosaurs (Horner, 1984).

Dinosaur bones would be the only fossils expected in the EIS area that would be significant by the following definitions:

1. Significant. A find shall be judged significant if it:
   a. is a vertebrate; or
   b. provides important information on the development of biological communities or interaction between botanical and zoological species; or
   c. provides important information on evolutionary trends relating living inhabitants to extinct organisms; or
   d. demonstrates unusual or spectacular circumstances in the history of life; or
   e. is a rare species in danger of depletion by the elements, vandalism, or conflicting resource development and/or is not found in other geographic locations. Other criteria may be added by individual forests or cover local situations such as petrified forests, concentrations of petrified stumps, etc.
2. Nonsignificant. An individual fossils-find is defined as nonsignificant if:
   a. the species occurs extensively throughout a large geographic area;
   b. it does not provide additional scientific data not found in other specimens of the same species; and
   c. it is an invertebrate or paleobotanical fossil and does not meet the criteria defined under Significant.

CULTURAL RESOURCES

The remains of prehistoric cultural activities within the EIS area vary with topographic zones. There is a low probability of buried cultural remains or permanent campsites in the steep sided canyons or on the narrow ridges to the west. Native peoples may have visited the area for spiritual purposes, tool stone materials, plant collections or mineral mining.

Between these steep zones and the alluvial fan remnants to the east, cultural remains may be related to game and plant procurement. The frequency and complexity of cultural resources will increase in the eastern portions of the EIS area. The topography and natural resources of this portion of the EIS area are more favorable to activities such as camping, which leave a more permanent archaeological record. The development of deeper and buried soils improves the potential for the presence of buried cultural horizons.

Little cultural resource inventory has been done in the EIS area; resulting in a small sample of identified archaeological sites. Ten stone circle sites have been recorded in the eastern portion of the EIS area. Eight additional sites (six stone tool manufacturing areas, one burial site and a rock art site) have been located in the western portion. The Old North Trail was a north-south travel route stretching from Canada to Mexico. Portions of the trail have been reported on private lands along the Rocky Mountain Front and may exist within the EIS area.

SOILS

(Issue: General, Oil & Gas Operations)

Soils in the Blackleaf EIS area have been inventoried and described at the land type level, a third order soil survey as defined in *Land System Inventory* (USDA Forest Service, 1976, RI-76-20). This land type inventory is a soil survey that uses landform, habitat type, and soil to characterize mapping units; and to contrast their suitability for more commonly applied land management practices. A complete description of the land types and their suitability ratings can be found in Appendix I.

The Blackleaf EIS area consists of a series of generally parallel north-south trending ridges and valleys. The ridges are mostly formed of limestone and the valleys are underlain by sandstones and shales. The original geologic structure has been extensively modified by glaciation in the Rockies and most present landforms were shaped or altered by alpine or valley glaciers.

VEGETATION

(Issues: Wildlife, Visual Resources, T&E Species)

Vegetation in the EIS area varies from broad, rolling prairie grasslands at lower elevations, to dense conferous forests and alpine rocklands at higher elevations. About 25 percent of the area is dominated by grasses, either as prairie grassland or meadows. Coniferous forests occupy about half of the Blackleaf EIS area, with dense forests (40-100 percent crown cover) on 34 percent of the area and open forests (10-40 percent crown cover) on 14 percent of the area. Miscellaneous aspen, cottonwood and other forest areas of low canopy cover (less than 10 percent crown cover) occupies about 5 percent of the area. Wet meadows, riparian vegetation, fen and aquatic vegetation occur on about 5 percent of the area in scattered locations. Rockland, talus and scree are mostly associated with high elevations and occur on 14 percent of the area. The remainder of the area consists of small areas of alder and berry shrubfields, forbfields, snowchutes and vegetated talus.

The major grass species are rough fescue, Idaho fescue, bluebunch wheatgrass, western wheatgrass, Richardson's needlegrass, western needlegrass, Kentucky bluegrass, timber oatgrass and junegrass. Lower elevation forests are dominated by limber pine, Douglas-fir, Rocky Mountain juniper and common juniper. Englemann spruce, white spruce and aspen are common in moist, cool habitats along streams and mountain slopes. Lodgepole pine, subalpine fir and white-bark pine become more prominent at higher elevations.

Important forb and shrub species include cow parsnip, Angelica, bluebells, false hellebore, horsetail and various willow species along streams and moist areas. Grassland-forb and shrub species include lupine, balsamroot, sticky geranium, harebell, sugarbowl, shrubby cinquefoil, northern bedstraw, yarrow, fringed sagewort and hairy goldenaster. On the forested mountain slopes the more prominent forbs and shrubs include arnica, twinflower, Richardson's geranium, meadow-rue, clematis, tobacco-root, russet buffaloberry, spirea, snowberry and various huckleberry species.

No plants classified as threatened or endangered under the Endangered Species Act of 1973 are known to exist in the EIS area. However, there are rare plants of limited distribution that may require special management consideration to maintain diversity within the species gene pool. Rare plants are those species of limited distribution which are susceptible to elimination by modification of relatively small areas of habitat. Appendix J lists the rare plants with a high probability of occuring in the EIS area.

Noxious weeds are rapidly spreading throughout Montana and the Blackleaf EIS area. Leafy spurge, Spotted knapweed and Canada thistle are all present in or adjacent to the EIS area.

LIVESTOCK

(Issue: Local Economy, Private Landowners)

There are 530 cattle and 67 horses permitted on five U.S. Forest Service (USFS) allotments and one allotment administered jointly between the USFS and BLM in the EIS area. The USFS grazes its own horses on two additional allotments where no other livestock are permitted. Additional livestock are licensed by the Montana Department of State Lands.

These are the animal-unit-months (AUMs) permitted by each agency:

Agency	AUMs
USFS (Lewis & Clark NF)	1,188
Montana State Lands	433
BLM	291
Total	1,912

The Chicken Coulee Allotment Management Plan (AMP) is managed jointly by the Bureau of Land Management and Lewis and Clark National Forest and was first implemented in 1974. The management objectives of the plan are to improve the condition of the rangeland, wildlife habitat (emphasis on grizzly and mountain sheep) and watershed condition. Rangeland improvements such as fences, spring development and pipelines and livestock exclosures (to establish riparian grizzly habitat and protect spring developments) have been installed to manage livestock grazing.

Both the USFS and BLM have invested rangeland improvement money in this AMP. Currently a four pasture rest rotation grazing system is in effect, allowing each pasture in alternate years complete rest during the growing season. Approximately 233 cow-calf pairs are grazed each year in the remaining three pastures for the period of July 1 through September 30. Since the plan was implemented in 1974, range studies have shown an improvement in ecological condition of the vegetation.

Appendix K details the Chicken Coulee AMP and the allotments administered soley by the USFS.

WILDLIFE

The Rocky Mountain Front (RMF) has always been known for its exceptional wildlife values and most recently for its oil and gas potential. Resource managers saw the possible conflicts between oil and gas development and wildlife, so in 1980, an Interagency Rocky Mountain Front Wildlife Monitoring/Evaluation Program was initiated. A principal goal of this program was to sponsor study efforts whereby wildlife management guidelines, based on sound scientific findings, could be developed to aid land managers in their planning of human activities along the RMF. Guidelines have been used as developed and approved and were eventually printed and distributed (BLM et al. 1987). Hereafter, this document will be referred to as the Guidelines.

This interagency effort initiated baseline studies on mule deer, elk, bighorn sheep, Rocky Mountain goat, grizzly bear and raptors. In addition, numerous studies on most of these species had been undertaken previous to the formation of the interagency group and are available as a data base. The Montana Department of Fish, Wildlife and Parks (MDFWP) also conducts yearly population, habitat, and harvest trend studies on the RMF for those species that are hunted. Figure 2.10 in Chapter 2 shows the specfic seasons of use for these species.

Concurrent with the interagency monitoring program was the development of a cumulative effects model to facilitate computer analysis of impacts to the threatened grizzly bear from man's activities (U.S. Forest Service et al. 1986). Data is displayed by a Geographic Information System (GIS). Appendix G defines this modeling process in greater detail. The biological/geographical boundary for this system is the Bear Management Unit (BMU). The EIS area lies within the Birch/Teton BMU, which consists of 322 square miles.

Aquatic Environment

Fisheries are limited along the RMF because most drainages scour so severely during spring runoff that bottom organisms are not plentiful and streamside vegetation has been destroyed. Also, many of these streams dry up in the late summer and those that don't, often exhibit poor water quality and high temperatures in their lower reaches.

However, there are trout fisheries (cutthroat, brook and rainbow) and mountain whitefish in most of the perennial creeks in the EIS area (see Table 3.1 and Figure 3.3) (Bill Hill, MDFWP, personal communication). The native cutthroat, commonly called the Upper Missouri River cutthroat or west slope cutthroat, is listed by the State of Montana as being of special interest or concern. In addition, rainbow trout have been planted in Ostle Reservoir which lies on the south side of Antelope Butte.

Beaver activity is evident in some drainages, including the Antelope Butte swamp proper. Other furbearers found in these habitats include the muskrat and mink.

Limited waterfowl production occurs in Antelope Butte Swamp and other pothole areas along the eastern portions of the EIS area. No waterfowl inventories have been undertaken, but casual observation indicates that teal, mallards and shovelers are the most common nesters.

Upland Game Birds

Three species of forest grouse (blue, ruffed and spruce grouse) are common to the EIS area, but no specific studies have been undertaken to document their abundance or habitat preferences. Research from other areas (Mussehl et al. 1971) indicates the habitats existing along the RMF would be used by all three grouse species throughout the year. It is especially important to blue grouse in the spring, as they winter at high elevations, but descend in early spring to semi-open timber for breeding and brood raising. Ruffed grouse prefer the dense cover of mixed conifer and deciduous trees and brush which are common throughout the riparian areas of the RMF, especially where the mountains meet the prairie.

In addition, there is one species of prairie grouse (sharp-tailed grouse) inhabiting the EIS area. They are common to the area, and three "leks" (breeding/dancing grounds) have been located (see Figure 3.3). It would not be uncommon to see hungarian partridge near the prairie/agricultural borders, or even an occasional ringnecked pheasant in the riparian/agricultural areas, but neither bird nor preferred habitat is prevalent in the area.

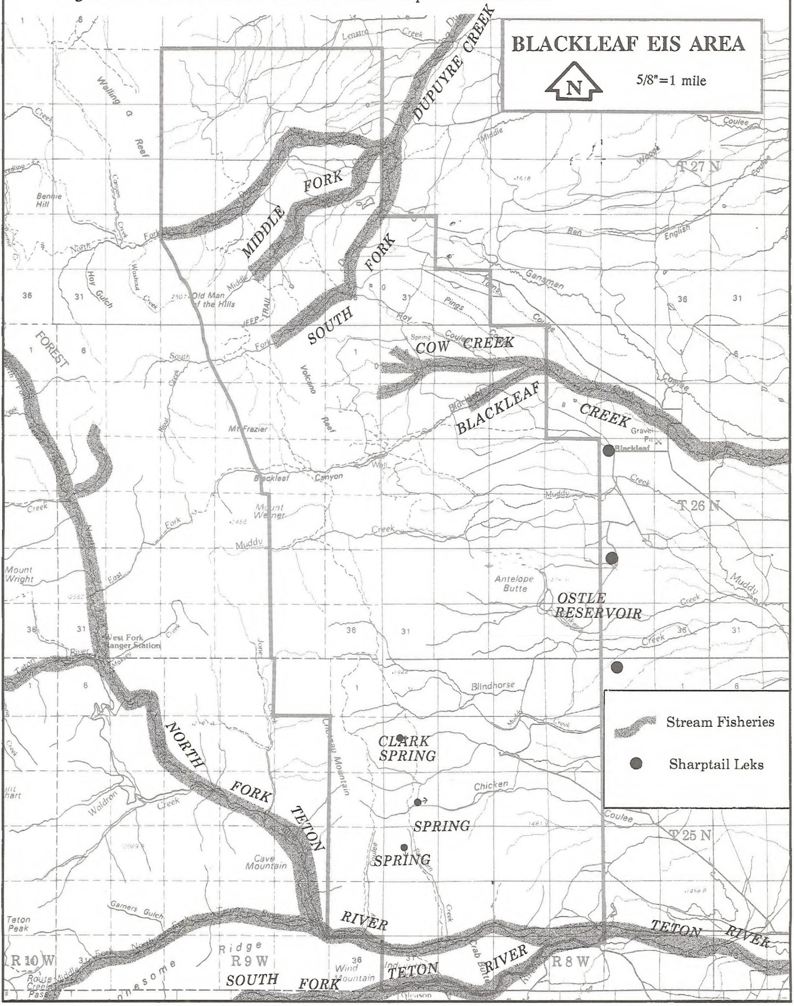
TABLE 3.1

EXISTING FISHERIES SPECIES IN THE BLACKLEAF/TETON EIS AREA[1]

Location	Cutthroat	Brook	Rainbow	Mountain Whitefish
Dupuyer Creek		X	X	X
No. Fk. Dupuyer Creek	X	X		
So. Fk. Dupuyer Creek	X	X (below falls)		
Middle Fk. Dupuyer Creek	X			
Cow Creek	X	X (on lower end)		
Blackleaf Creek		X		
Teton River	X	X	X	X
Ostle Reservoir			X	

[1]BLM, 1989

Figure 3.3 Known Stream Fisheries and Sharptail Grouse Leks.



Mule Deer

Mule deer are the most numerous big game animal on the RMF and this area is considered one of the most important mule deer wintering areas in the state, as evidenced by the large number of deer wintering here (see Table 3.2 and Figure 3.4).

Six primary and secondary winter ranges have been described along the RMF and associated transition ranges have also been described. Of these winter ranges, portions of three (Blackleaf-Teton, Dupuyer Creek and Scoffin Butte) lie within or nearby the EIS area (Kasworm 1981). A fourth range, Swanson Ridges, is occupied at moderate to high mule deer population levels (Olson 1984). The size of winter ranges and estimated population numbers and densities are given on Table 3.2. The number of mule deer wintering on each of the four winter ranges varies from year to year. A 1986 survey (Olson MDFWP, personal communication) revealed fewer deer than in previous years (see Table 3.2).

Important characteristics of highly used winter ranges, as compared to adjacent low use areas, are that winter ranges are consistently lower in elevation, have a wider availability of aspect classes, and have a greater percentage of the total land surface in moderate and steep slope categories. Although analyses are still incomplete, high density winter ranges appear to differ from low density winter ranges primarily in elevation. High density winter ranges are situated in areas that allow mule deer to move to relatively low elevations and still find broken terrain, favorable cover conditions, and aspect/slope configurations that promote snow melt during chinook conditions (Olson 1984). Important cover and forage areas identified on winter range include the habitat types of limber pine/rough fescue (*Pinus flexilis/Festuca scabrella*) and limber pine/juniper (*P. flexilis/Juniperus sp.*). The use of winter range feeding sites increases when these two habitat types are near the shrubby cinquefoil/rough fescue, rough fescue/Idaho fescue, rough fescue/bluebunch wheatgrass, big sagebrush/rough fescue, wet meadow riparian and swamp habitat types.

Additional information from mule deer monitoring studies on the RMF is available in two theses (Kasworm 1981) (Ihsle 1982), four annual reports to the BLM (Kasworm and Irby 1979) (Kasworm et al. 1980) (Mackie and Irby 1982) (Irby and Mackie 1983), a MDFWP report to the USFS (Hook et al. 1982), and numerous MDFWP Job Progress Reports. The most recent summary of mule deer ecology on the Front is contained in Ihsle-Pac, et al. 1988.

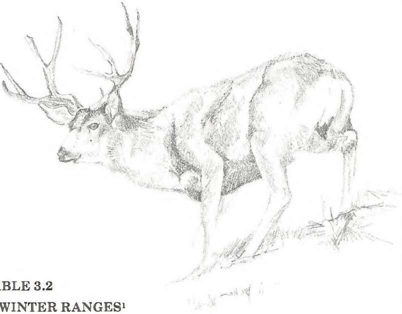


TABLE 3.2

MULE DEER WINTER RANGES[1]

Location	Total Winter Range km2	Primary Winter Range km2	Numbers Year of Survey 1980[2]/1986[3]	Numbers/km2
Scoffin Butte[2]	16.8	10.2	800-1,000/600	47.7-59.6[2]
Dupuyer Creek[2]	31.7	13.4	900-1,100/250	28.4-34.7[2]
Blackleaf-Teton[2]	73.4	20.9	400-500/450	5.5-6.8[2]
Swanson Ridges[4]	29.2	0.0	0-0 /300	0.0-0.0
Total	151.1		2100-2600/1600 less Swanson Ridges	

DEFINITIONS

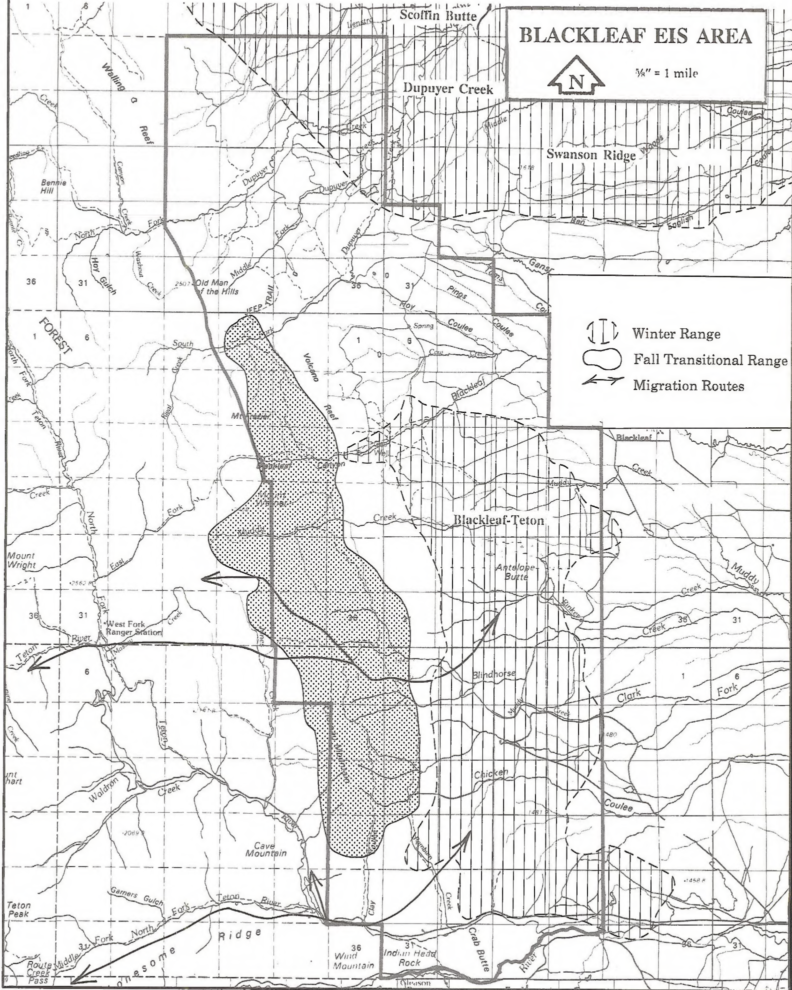
Primary Winter Range: Area where most mule deer are distributed during a "normal" winter; on the East Front this area is generally the lower face and beginning portion of the prairie where the Limber pine savanah is common.

Secondary Winter Range: The area that is usually adjacent to primary winter range but receives noticeably less use by mule deer during the "normal" winter; however, these areas often receive considerable use by deer in the spring. These areas are generally further from timber cover than primary winter range areas.

Total Winter Range: Primary and secondary winter range combined.

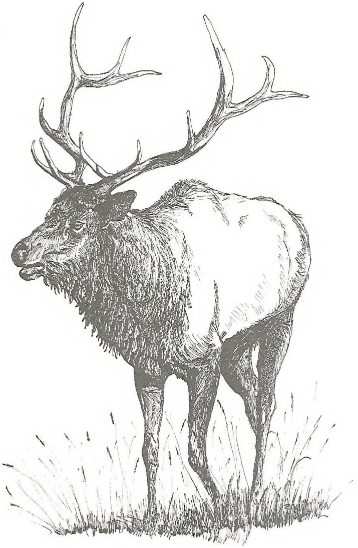
[1]*BLM/MDFWP, 1989*
[2]*Data from Kasworm, 1981*
[3]*Data from Olson (Personal Communication), 1986*
[4]*Data from Olson, 1984*

Figure 3.4 Mule Deer Winter Ranges Associated with the Blackleaf EIS Area.



White-tailed Deer

No specific monitoring studies have been initiated for white-tailed deer on the RMF. However, healthy populations do exist within riparian areas including river corridors and swampy areas. Antelope Butte Swamp in the central portion of the EIS area is an important whitetail area. In addition, all forks of Dupuyer Creek, Cow Creek, Blackleaf Creek, Blind Horse Creek, and Pamburn Creek are whitetail concentration areas.



Rocky Mountain Elk

Depending on the severity of the winter approximately 180 elk winter in and adjacent to the EIS area (see Figure 3.5) (Olson 1986, MDFWP, personal communication). Radio telemetry research indicates that during abnormally mild winters, some elk choose to remain on summer ranges in the upper reaches of the Middle Fork of the Flathead River, some 20 air miles to the west of the Continental Divide. Elk that migrate west of the Divide to the Flathead drainage probably make up 50-60 percent of the expected total on the winter range. The number of wintering elk in the EIS area therefore, may vary from winter to winter. Winter/spring inventories in 1989, yielded an estimated population of 325 elk. It appears that the total elk herd is increasing (Olsen, 1989, MDFWP, personal communication).

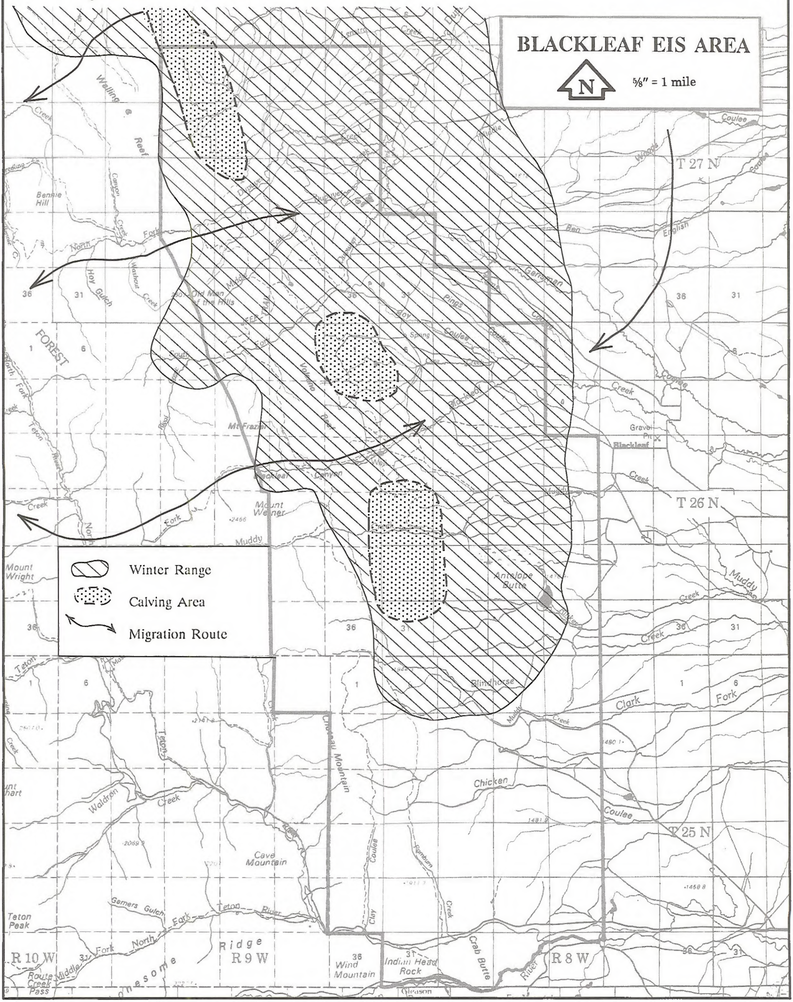
Radio telemetry research has shown that two major herds winter in and adjacent to the EIS area. One segment remains in the Cow Creek-Scoffin Creek drainages and numbers approximately 100-120 animals. The other herd can be found on the Blackleaf Wildlife Management Area and consists of approximately 60-80 elk. Collared elk in one herd unit have not been observed on the other unit, so it is apparent that there is no, or very little overlap between these herds during the wintering period (based on observation and telemetry data).

Elk in the EIS area migrate to several different summer ranges; a portion of the herd travels northward to the Badger-Two Medicine drainages, some are found in the Middle Fork Flathead drainage, others stay on the east side of the Divide at higher elevations, and some are known to be permanent residents of the Front. Migration corridors include the Blackleaf, South Fork Dupuyer, North Fork Dupuyer and Birch Creek Canyons.

Calving areas include the entire EIS area from Dupuyer Creek to the Teton River. Documented calving is known to occur near Twin Lakes, on the Blackleaf Wildlife Management Area, Cow Creek, and all forks of Dupuyer Creek. No definite perimeters can be drawn around the calving grounds due to lack of intensive research, but the most probable grounds are shown on Figure 3.5.

In general, most of the migratory animals are on the winter range by January 1, although herd units often seem to form in early December. Elk are commonly seen along the Front until May 15.

Figure 3.5 Elk Habitat in the Blackleaf EIS Area.



Bighorn Sheep

Three bighorn sheep population units have been identified in the EIS area; Ear Mountain, Choteau Mountain and Walling Reef (Andryk 1983). The last two lie within the EIS area. The Walling Reef population appears to be expanding its range to the north, south and west. It was started from a transplant of 37 sheep from the Sun River in March 1976. The Ear Mountain unit seems to be expanding north and west, and it is undetermined whether the Choteau Mountain unit (a product of expansion by the other two units) is expanding.

Bighorn winter ranges and lambing areas are shown on Figure 3.6 (Andryk 1983).

Population estimates for Ear Mountain, Choteau Mountain, and Walling Reef herd units were made in August 1982, and January 1983, and averaged 100, 35 and 70 bighorns respectively.

Important winter-spring habitat components include; open grassland and old burn cover types with elevations of 5035 to 5537 feet, which are less than 300 feet from rocky terrain (escape cover).

Important summer and fall habitat components include open rocky bluff and cliff sites, and elevations of 6640 to 8050 feet. Timbered sites are also used during fall. Grass-forb communities appear to be of lesser importance on summer ranges than on winter-spring ranges (Andryk 1983).

Additional distribution and habitat information about bighorn sheep can be found in several sources including (Erickson 1972), (Frisina 1974), (Andryk 1983), (Hook 1984) and the Interagency Rocky Mountain Front Wildlife Guidelines (BLM et al. 1987).

Rocky Mountain Goat

The RMF range contains one of the largest contiguous populations of mountain goats in the state. Studies conducted for the mountain goat portion of the Interagency RMF studies concluded that mountain goat distribution and population numbers have diminished since the 1950s (Joslin 1986). An important segment of this overall population occurs in the EIS area and its population trend was also down. This segment is called the Teton-Dupuyer herd (see Figure 3.7) and population estimates range from 53 to 113 mountain goats, or in other words, one goat per 1 to 2 square miles in occupied habitat (Joslin 1986).

Mountain goat habitats have been classified as occupied yearlong (includes both summer and winter seasons), suitable low occupancy and transitional. Kidding-nursery and breeding areas have been delineated within occupied yearlong habitats and mineral lick locations have been plotted (Figure 3.7). Concentration areas, or samples of areas where goats were consistently observed have also been defined (Joslin 1986).

Most of the environmental features conducive to preferred mountain goat habitat occur in the western portion of the EIS area. Slopes greater than 70 percent and elevations over 7,000 feet are preferred however, discrepancies in the perception of what constitutes mountain goat habitat can occur (Joslin 1986).

Mineral licks within the EIS area (see Figure 3.7) are more than simply locations where goats congregate to lick salt. They are important physiographic features which influence the home range size and configuration of each goat using the area. For example, the Blackleaf mineral lick influenced the movements and home ranges of all 34 marked mountain goats in the Teton-Dupuyer segment. Extreme care should be exercised when managing man's activities near mineral licks (Joslin 1986).

Figure 3.6 Bighorn Sheep Habitat in the Blackleaf EIS Area.

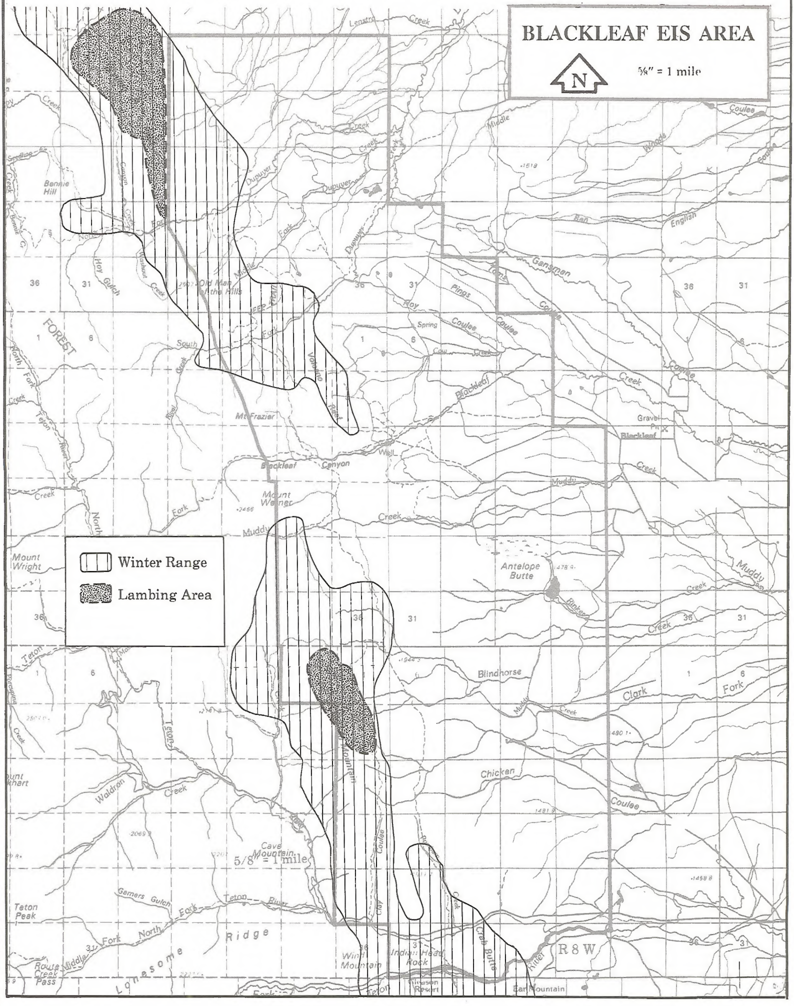
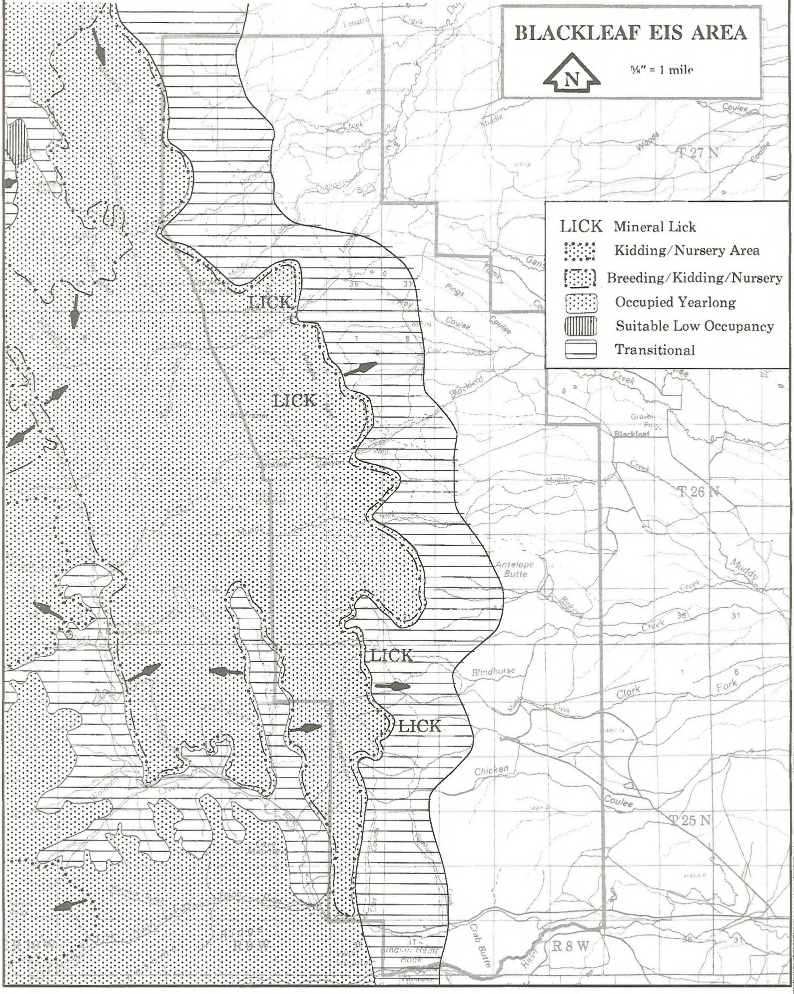


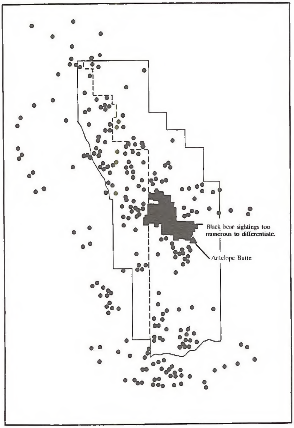
Figure 3.7 Mountain Goats in the Blackleaf EIS Area.



Black Bear

Black bear distributions developed from radio locations, trappings, and sightings are shown on Figure 3.8. As evidenced by this figure, the EIS area is important to black bear during all seasons (Aune et al. 1986). Riparian areas such as Antelope Butte Swamp plus the diverse habitats found along the face of the Front are of high value to black bear.

Figure 3.8 Black Bear Distribution in the Blackleaf EIS Area as Represented by Observational Data Collected from 1976-1986.



Enlargement of Figure 36. of the East Front Grizzly Bear Studies; Aune K. & B. Brannon 1987 showing only the Blackleaf EIS Area.

(note: there is no differentiation in sighting season.)

Mountain Lion

Lions occur along the RMF, as they do in most places in Montana where mountain-foothill mule deer winter ranges are prevalent. Population densities have not been determined.

Furbearers

Bobcat, lynx, and wolverine are the principle furbearers that may occur in the EIS area. Bobcats have been observed using Antelope Butte Swamp, but their relative abundance is unknown. Neither thick stands of lodgepole pine nor large populations of snowshoe hare occur, which may indicate the area is not especially suitable for lynx (Koehler et al. 1979).

Wolverines occupy large seasonal and yearly ranges in northwestern Montana and prefer mature and intermediate timber stands for cover in association with carrion or prey areas such as cliffs, slides, blowdown, basins, swamp and meadows (Hornocker and Hash 1981). These habitats do occur on the RMF, however they probably function as buffers to the vast expanses of wilderness to the west which are necessary for wolverine survival and not as key wolverine habitat.

Raptors

Golden eagle, northern harrier, prairie falcon, Swainson's hawk, red-tailed hawk and American kestrel are the most common diurnal species using the EIS area. The great horned owl and northern saw-whet owl are the most common nocturnal species (Dubois 1984).

Cliff and riparian habitats are the most important nesting habitats for these species. Important habitat delineations for the two most common raptors (prarie falcon and golden eagle) are shown on Figure 3.9.

Figure 3.10 shows the bald eagle winter concentration areas and potential peregrine falcon nesting areas.

Other Species

Numerous small mammals and birds occupy the variety of mountainous and prairie habitats found in the EIS area, but species specific information is limited. However, species listings do exist and include Flath 1984, Skaar 1985, a list made by Kristi Dubois during her raptor study and filed at the BLM Great Falls Resource Area, and a listing provided for the RMF counties by the Montana Natural Heritage Program in 1986.

THREATENED OR ENDANGERED WILDLIFE SPECIES

Four wildlife species classified as threatened or endangered under the Endangered Species Act of 1973 (50 CFR 402, 43 CFR 870) occur in the EIS area. They are the threatened grizzly bear and endangered gray wolf, bald eagle and peregrine falcon.

Grizzly Bear

The grizzly bear of the RMF thrives on the transitional edge between the grassland shrub habitat type and the mountainous forest habitats. This area serves as the last plains habitat occupied by grizzlies. This edge contains habitat components important to the grizzly during all seasons, except for the winter denning period. The EIS area encompasses much of this transitional edge. The riparian types such as those occurring in the Antelope Butte Swamp are key foraging and security areas. Figure 3.11 shows the spring seasonal constituent element, of critical importance to the grizzly as well as denning habitat (Aune 1987 and Brannon). Figure 3.12 shows this element in relation to grizzly bear distribution from observations between 1980 and 1987.

Population estimates of grizzly bears on the RMF portion of the Northern Continental Divide Ecosystem range from 62-93 bears. This figure does not include the Badger-Two Medicine Unit, which is estimated to contain an additional 16-20 individuals (Dood et al. 1986). The 322 square mile bear management unit (BMU) and the EIS area probably support three breeding age females and a total population of 21 grizzlies. A much more indepth discussion of grizzly bear biology is given in the Biological Evaluation/Biological Opinion (see Appendix L).

Studies of the grizzly bear on the RMF began as early as 1974 and have continued until the present (Schallenberger, 1974, 1976, 1977; Schallenberger and Jonkel, 1978, 1979, 1979a, and 1980; Aune and Stivers, 1981, 1982, 1983, 1985; Aune, Stivers and Madel, 1984; Aune, 1985; Aune, Madel and Hunt 1986; Aune and Bronnon 1987; and Aune 1989).

Figure 3.9 Prairie Falcon and Golden Eagle Cliff Nesting Habitats found in the Blackleaf EIS Area.

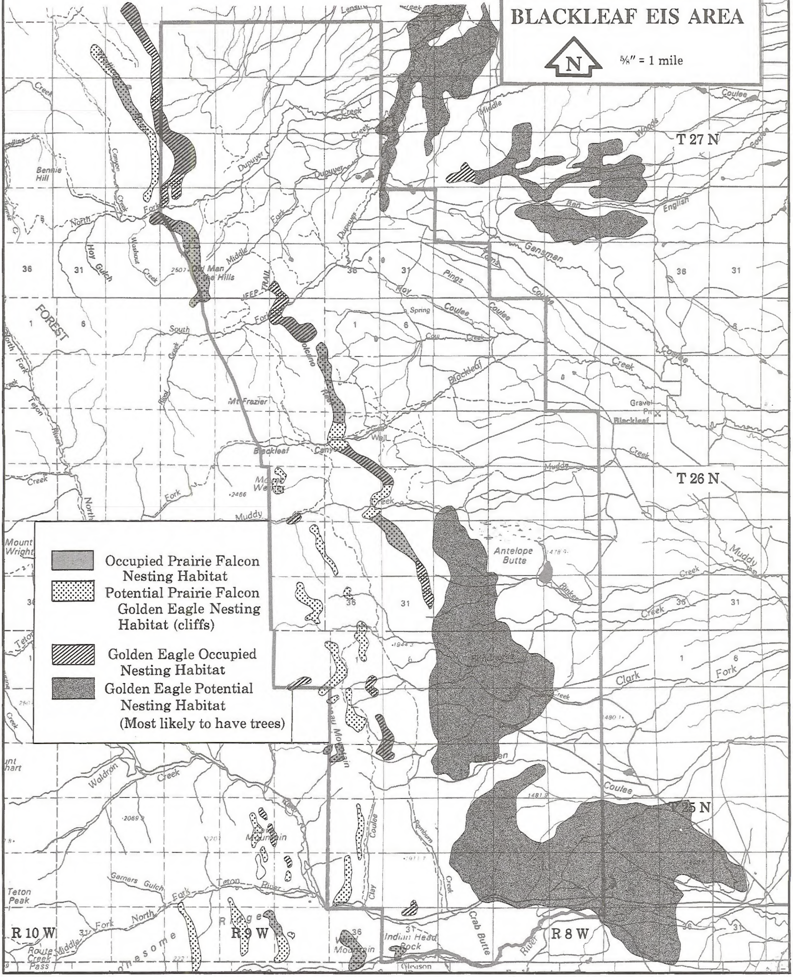


Figure 3.10 Threatened and Endangered Species.

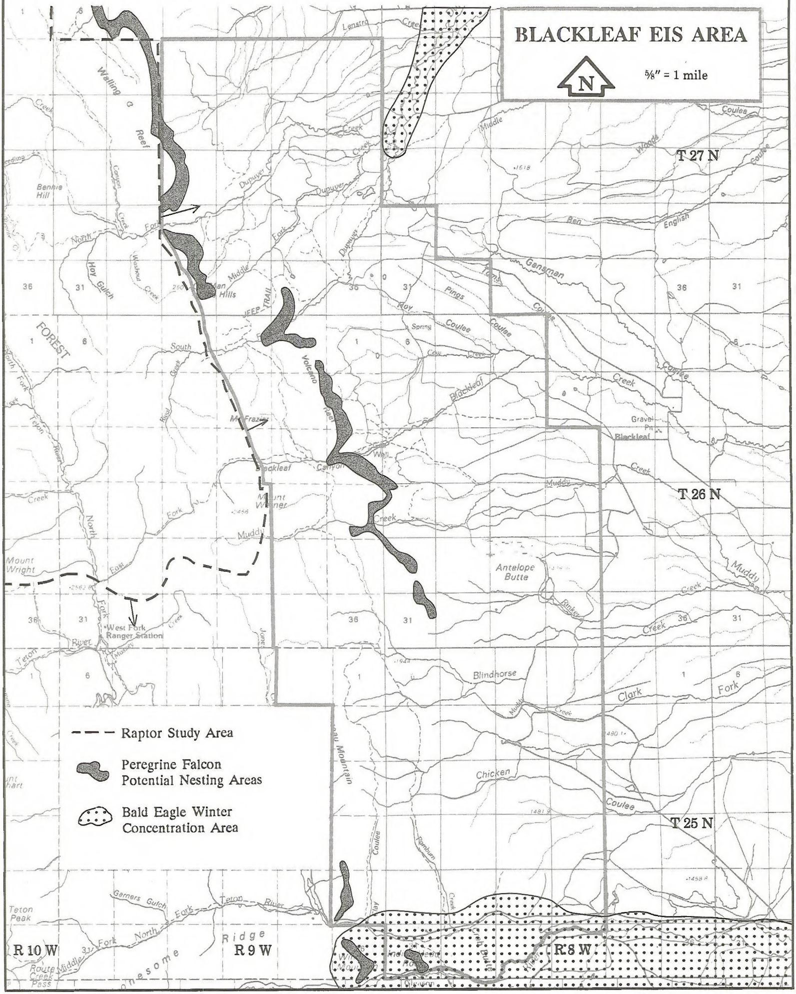


Figure 3.11 Grizzly Bear Spring and Denning Habitat in the Blackleaf EIS Area.

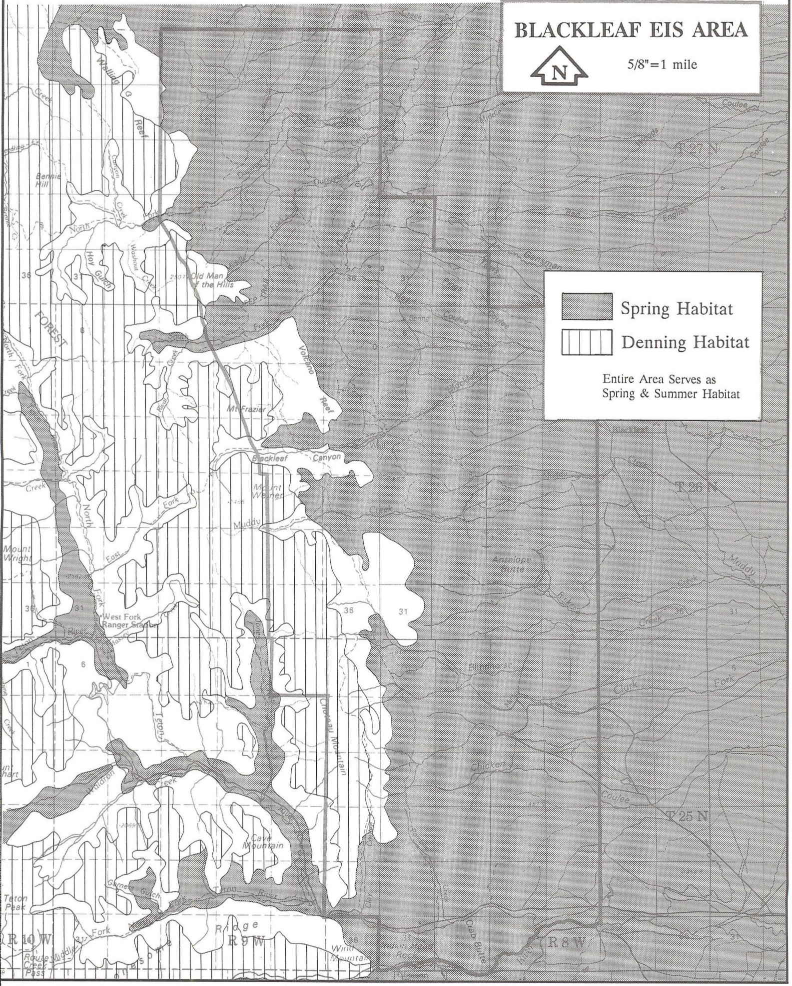
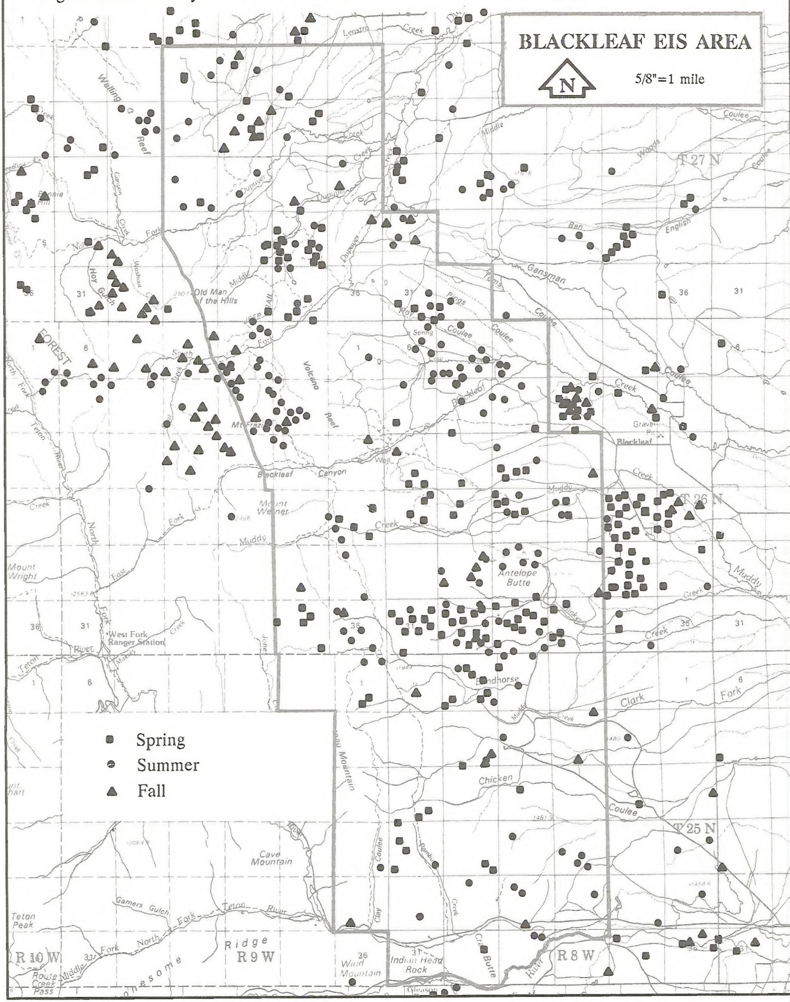


Figure 3.12. Grizzly Bear Distribution 1980-1987 in the Blackleaf EIS Area.



Gray Wolf

The Wolf Ecology Project, University of Montana (Mattson and Ream 1978) has gathered wolf occurrence information on the Rocky Mountain Front. Most wolf observations were made prior to that project but with the recent advent of the "magic pack" in Glacier National Park (Robbins 1986, Ream et al. 1985, Ream 1985) it does appear that significant occupation by wolves down the Rocky Mountain Front could become a reality. The Rocky Mountain Front would be excellent wolf habitat because of its large number of ungulate winter/spring ranges and because of the large expanse of wilderness (Bob Marshall ecosystems) behind it. A more indepth discussion concerning wolf recovery is given in the Biological Evaluation/Biological Opinion (see Appendix L).

Peregrine Falcon

No nesting peregrine falcons are known along the RMF, however the area does offer suitable cliff habitat, should reintroduction of captive bred young birds be pursued (Dubois 1983). The best peregrine habitats are those cliffs which are close (within 3.0 miles) to extensive riparian habitat; over 165 feet in height and 0.6 miles in extent; with numerous nesting ledges; and the majority of the cliff under 7,590 feet elevation (Dubois 1983). Cliffs in the EIS area which meet those requirements include Muddy Creek and Blackleaf Creek Canyons, Rinker Creek, North and South Forks of Dupuyer Creek, and the northern portion of Walling Reef (see Figure 3.10).

A more indepth presentation of peregrines and the RMF is given in the Biological Evaluation/Biological Opinion (see Appendix L).

Bald Eagle

No known bald eagle nest sites have been documented, however bald eagles are present on the RMF from September through April as an uncommon winter resident and migrant. Eagle observations are normally south of the EIS area where fisheries and open water were more common (Dubois 1984).

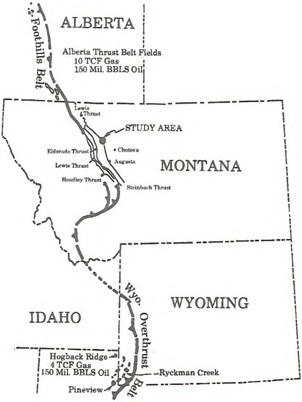
GEOLOGY

(Issue: Oil & Gas Operations)

The Blackleaf EIS area is located on the eastern edge of the Northern Disturbed (Overthrust) Belt. It is a small segment of the Cordilleran thrust and fold belt which extends from western Canada southward through the Western U.S. (see Figure 3.13) (Mudge, 1982). The Overthrust Belt is a zone of north trending, closely spaced, westerly dipping thrust faults on which older sedimentary rock layers were thrust eastward over younger rocks. The movement took place in late Cretaceous through early Tertiary time (55 million years ago).

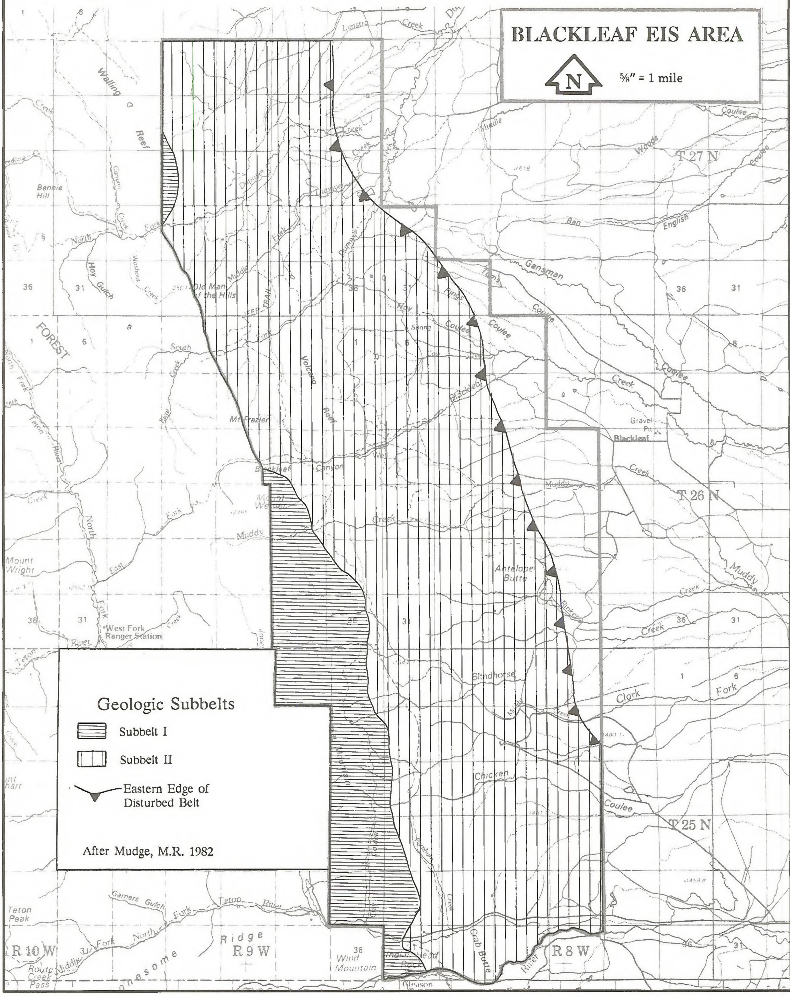
The Northern Disturbed Belt is divided into four subbelts based on stratagraphic and structural characteristics (see Figure 3.14) (Mudge 1982). The easternmost is Subbelt I and is equivalent to the eastern part of the Alberta Foothills. It contains westerly dipping thrust faults of small displacement, folds and some transverse faults that repeat Lower and Upper Cretaceous rocks. The nonresistant sandstone and shales form low hills with little relief.

Figure 3.13 Location of Overthrust Belt and Relationship to Major Oil and Gas Fields.



Modified from Warne, 1984

Figure 3.14 Northern Disturbed Belt



Immediately west of Subbelt I is Subbelt II which includes the Sawtooth Range, Mount Warner and Old Man of the Hills (see Figure 3.14). It contains closely spaced thrust faults of large displacement that repeat Paleozoic and Lower Mesozoic rocks. The Paleozoic age limestones and dolomites form bold rugged northwest trending cliffs. The Mesozoic age sandstones, siltstones and shales form northwest trending valleys.

Further west and out of the EIS area is Subbelt III. It is mostly thrust-faulted and folded Cretaceous rocks that form a broad valley west of the Sawtooth Range, such as the North Fork of the Sun River. Subbelt IV consists of thrust-faulted and folded Proterozoic and Paleozoic sedimentary rocks that have been thrust eastward many miles. They have overridden Subbelts II and III in the northern and southern parts of the Disturbed Belt.

Surface Geology

Devonian through Cretaceous age sedimentary rocks are found on the surface in the Blackleaf EIS area (Mudge, Earhart 1983). They are shown in Figure 3.15 and briefly described in Appendix M.

Structural Geology

The EIS area is located along the leading edge of the Overthrust Belt. The eastern portion of the area is outside the thrust belt and consists of nearly horizontal sedimentary rocks of Cretaceous age. They dip gently to the west.

The east-central portion of the EIS area is within Mudge's Subbelt I, which, on the surface, consists of westerly dipping thrust faults of small displacement and folds that repeat Lower and Upper Cretaceous rocks (Clayton, Jerry, Mudge, Melville, et al. 1982). Surface anticlines are present between the North Fork of Dupuyer Creek and Muddy Creek and in the Antelope Butte area. To the south is the Teton River Anticline, (which is well exposed along the North Fork of the Teton River) and numerous smaller parallel anticlines and synclines. At depth the entire section from Devonian through Cretaceous is repeated many times by thrust faults.

The western portion of the unit consists of Mudge's Subbelt II. It contains closely spaced thrust faults of large displacement and repeat Paleozoic and Lower Mesozoic rocks. It can generally be described as overlapping Mississippian limestone (Mudge 1983).

OIL AND GAS RESOURCES

(Issues: Wildlife, Visual Resources, Air Quality)

Present production from the Blackleaf gas field is from Subbelt I (see Figure 3.14). The western structural trap is where the Paleozoic terminates as a wedge edge against an underlying thrust fault. Paleozoic rocks are repeated by numerous thrust faults which formed drag folds resulting in a wedge edge. The gas has accumulated in the Sun River Dolomite Member of the Mississippian Madison Group (see Figure 3.16).

The Knowlton gas field (eastern Blackleaf) resulted from a backthrust or a reverse fault-bounded horst or "pop up" block in which gas and gas-condensate was trapped in the Mississippian Sun River Member (Napier, 1982).

General field characteristics include traps trending in a northwesterly direction which are generally thin in east-west cross section and associated with thrusting.

Future development in Subbelt I will focus on extending existing structures. The eastern Knowlton structure appears favorable to the south and the western Blackleaf has potential for northward extension. Future development may be associated with additional wedge edge structures to the west and possible drag folds associated with fault contacts between Subbelts I and II in the southwestern part of the area.

Subbelt II is very complex and development within this subbelt is expected to be low. Potential targets may be drag folds at the contacts between Subbelts I and II, and the repeated section at depth.

There are presently two producing gas wells (1-5, 1-8) and two shut-in gas wells (1-13, 1-19) in the EIS area. The formation containing these commercial quantities is a fractured dolomite called the Sun River member of the Madison formation of Mississippian age. A fifth well is temporarily abandoned and does not appear able to produce economic quantities of gas, but is proposed as an injection well for the disposal of produced water.

The wells were drilled to two separate thrust sheets and are producing from different reservoirs formed by thrusting and faulting (Johnson 1984). These reservoirs have different initial pressures and probably produce at different rates. The 1-8 and 1-5 wells are producing from a reservoir with an estimated reserve of 35 billion cubic feet (BCF) of gas. If half of those reserves could be produced from each well, it would indicate a producing life of 15 to 20 years for each well. Since the wells in the other reservoir (1-13, 1-19) have lower initial pressures, they would have a shorter life.

The product from this producing reservoir is a combination of gas, condensate and water. The gas also contains Hydrogen Sulfide, a highly toxic, reactive gas. It is necessary to process this product prior to sales. The initial step after the product comes out of the well is separation into the three components; gas, condensate and water. After these are separated the gas is run through a dehydration unit to remove any water vapor left in the gas stream.

There are two production facilities located in the Blackleaf Unit; one is at the 1-8 well and the other is at the 1-5 well. These facilities separate the gas condensate and water. The condensate is piped to storage tanks at each well and the water goes to an evaporation pit on each location. The condensate is removed about every 10 days by truck; however, there is storage capacity for approximately 2 months of condensate (see Figure 3.17). The gas is then piped to the Gypsy Highview Sweetening Plant about 14 miles northeast of the 1-8 well.

Figure 3.15 Geologic Formations.

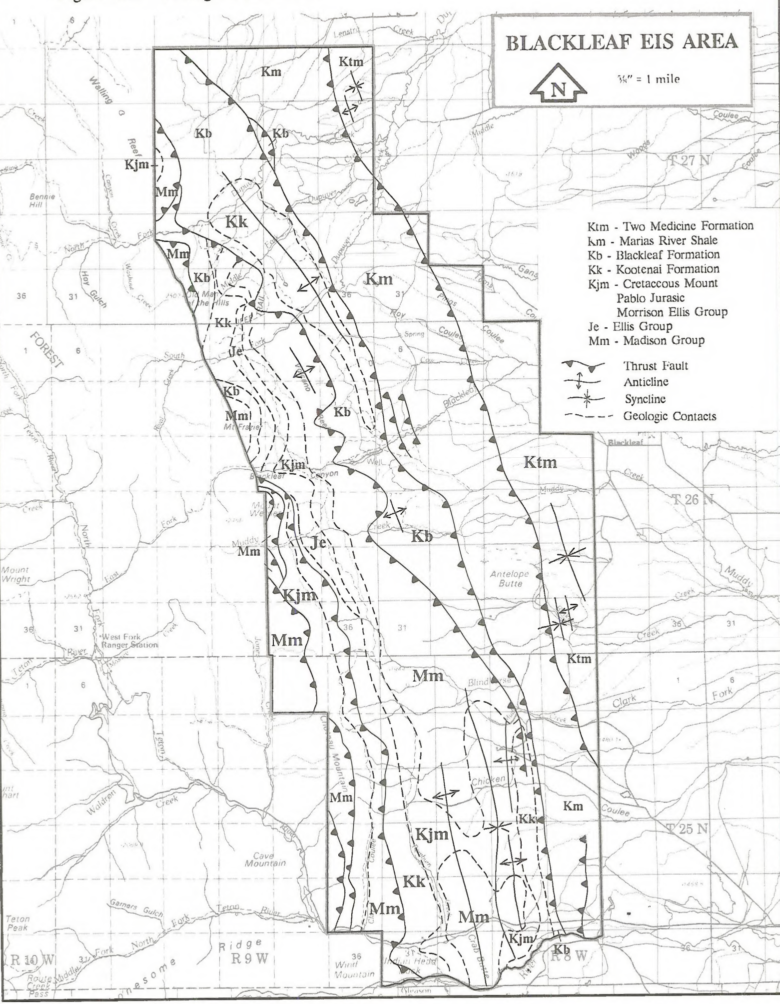
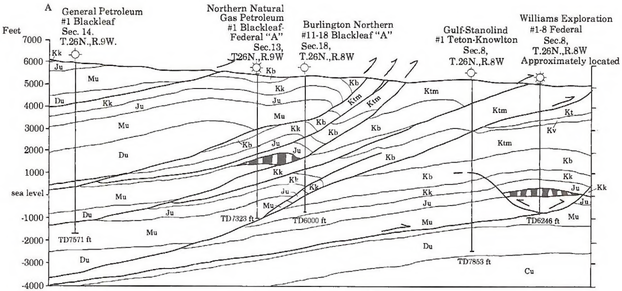


Figure 3.16 Cross Section of Blackleaf Gas Field.



CRETACEOUS

Kt	Two Medicine Formation
Kv	Virgelle Sandstone
Ktm	Telegraph Creek Formation and Marias River Shale
Kb	Blackleaf Formation
Kk	Kootenai Formation
Ju	JURASSIC ROCKS Not shown on map A
Mu	MISSISSIPPIAN ROCKS
Du	DEVONIAN ROCKS
Cu	CAMBRIAN ROCKS

CONTACT

FAULT—Dashed where inferred: arrow shows direction of movement

DRY HOLE

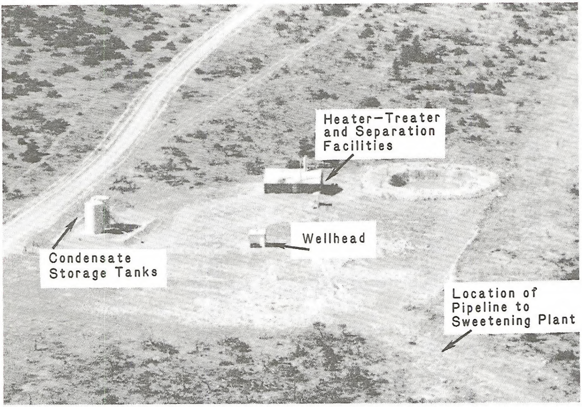
SHUT-IN GAS WELL

GAS RESERVOIR

TOTAL DEPTH OF DRILL HOLE

TD7571 ft

Figure 3.17 Photograph of a Tank Battery.



SURFACE WATER

(Issues: General, Water Quality)

Water quality is mostly very good, except during peak flows when a heavy load of sediment is transported, although water quality may be affected in some lower elevation areas by livestock use. The water has a relatively high amount of dissolved solids, reflecting the large amount of limestone and other relatively soluble rock in the watershed (specific conductance measured range of 190 to 340 micromhos/cm). The protozoa Giardia is known to be a human health problem for drinking water in the back country and should be suspect here also.

Surface water in the EIS area drains west to east. The northern one-third of the area drains through Dupuyer Creek into Birch Creek, then into the Two Medicine River (State Basin 41M — see Figure 3.18). Most of the remaining area drains through Muddy Creek (much of that through Blackleaf Creek) into the Teton River (State Basin 410). The remainder of the area drains directly to the Teton River.

Surface water drains quickly from the western part of the EIS area because there is little surface soil on the steep slopes to absorb it. Most surface water on the eastern portion of the area sinks into the thick beds of exposed gravel left during an earlier era, though in some places the water table reaches the surface.

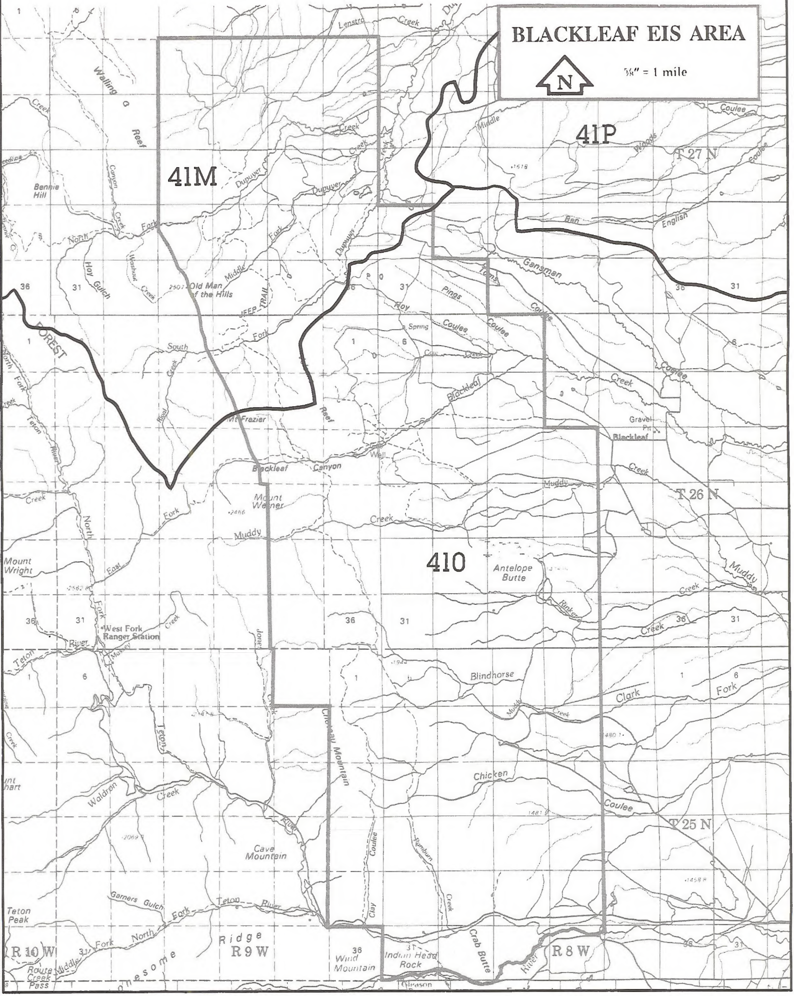
The major streams in the area are Muddy Creek, Blackleaf Creek and the forks of the Teton River and of Dupuyer Creek. All streams coming from the mountains across the area are extremely flashy, carrying huge amounts of suspended sediment and bedload during intense rains.

The North and South Forks of the Teton River and Dupuyer Creek are perennial. The Teton River and its two forks, on the south boundary of the area, drain a large watershed and were dramatically affected, or gutted during the 1964 and 1975 floods. Organic debris (uprooted trees) was burned or otherwise removed, and inorganic debris (gravel bedload) was bulldozed to the side after the floods, creating a very unnatural channel.

Blackleaf and Muddy Creeks flow during late spring and summer (about May through August), but this flow quickly disappears into the streambed gravels, except during peak flow times. Peak flow and any flooding usually result from snowmelt or spring rains in May or June, however flash flooding can occur through early autumn. Precipitation from mid-autumn through early to mid-spring is in the form of snow. Partial streamflow records from 1981 and 1982 (U.S. Forest Service) show the flashy character of the Blackleaf Creek. Muddy Creek is particularly notable for its scenic deeply incised gorge and waterfall.

Other surface water resources in the EIS area include several glacial potholes with small ponds, a 40-acre reservoir on Rinker Creek east of Antelope Butte, a small reservoir on the Clark Fork of Muddy Creek and Antelope Butte Swamp, a large wetland of about 200 acres.

FIGURE 3.18 STATE WATER BASINS



Neither of the two state basins (41M for the Two Medicine River drainage and 410 for the Teton River drainage as shown on Figure 3.18) have preliminary water rights adjudications. However, all surface water flow has been appropriated, or at least claimed, for irrigation. Much of the Teton River is diverted into Bynum and Eureka Reservoirs, for irrigation use. Chicken Coulee (Blacktail Creek) also drains into Bynum Reservoir. The Forest Service has claimed stockwater use on Scoffin Creek, the North and South Forks Dupuyer Creek, North Cow Creek, Cow Creek, and five spring developments in the area on the National Forest lands. The Bureau of Land Management has claimed stockwater use for three springs, one of which is developed, on public lands in the area. The MDFWP has acquired some water rights within the area, however the extent of these rights is not fully known.

Another important surface water use is providing fish and wildlife habitat (especially in the Antelope Butte Swamp). The MDFWP has rated most of the North and South Forks of Dupuyer Creek, and a short reach of Cow Creek upstream from Blackleaf Creek, as a Substantial Fishery Resource (Value Class III). The Teton River, its two forks, and a portion of the North Fork Dupuyer Creek have been rated as a Moderate Fishery Resource (Value Class V). The lower (Moderate) rating is largely a result of flood scour.

The Muddy Creek drainage maintains a Class B-2 state water quality standard while the rest of the EIS area has a Class B-1 standard. Both of these standards were established to maintain water quality for drinking, culinary and food processing purposes after conventional treatment. These standards also maintain water quality for bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply without treatment. The difference in the two standards is that B-2 provides for only marginal propagation of salmonid fishes and associated aquatic life. Both classifications provide a very similar list of specific standards for various parameters, with only slightly lower requirements for the B-2 classification. Consideration for maintenance of the B-1 standard should also be given to the drainage area of Cow Creek, since its lower reach provides a substantial fishery resource.

GROUNDWATER

All geologic formations in the area could contain groundwater, with yields and quality varying, depending on the lithology of the formation. Those rock units with a high degree of porosity and permeability (unconsolidated surface gravels, sandstones, and limestones) have the potential to contain large amounts of water. Those with low porosities and permeability contain little water.

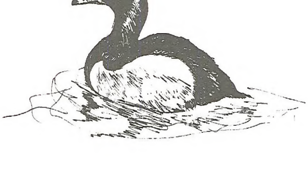
There is a rapid surface water run-off in this area, as there is little soil on the steep slopes to absorb and store the water. Most recharge to groundwater appears to occur on the gravel filled valley bottom and the thick gravel beds on the flatter areas east of the forest. Blackleaf and Muddy Creeks and various smaller creeks flow during the early summer on the forest but quickly disappear into the stream bed gravels east of the forest. The water percolates down through the gravels and may accumulate on the tops of the less porous underlying bedrock, as shallow groundwater. Over time, the water would slowly enter the deeper, less porous bedrock. Shallow groundwater supplies most of the water wells in the general area. Upon entering deeper bedrock units the salinity and amount of dissolved solids generally increases.

The Mississippian Madison Limestone is a major, deep aquifer in central and eastern Montana (Downey 1984). The Little Belt Mountains and the Snowy Mountains are significant recharge areas. The Madison rocks within the EIS area are also capable of transmitting water. This area was not identified as a recharge area for the Madison (Downey 1984).

The large surface exposures of Cretaceous Age sandstones, siltstones and mudstones contain water as a function of porosities; the mudstones containing little water and the sandstones containing larger amounts. Water within these rocks is expected to contain dissolved salts.

There are large glacial deposits of tills and outwash throughout the EIS area overlain by recent accumulations of alluvial gravels, talus and colluviam. The glacial tills are generally impervious to water. Glacial tills are probably acting as a dam and allowing the formation of Antelope Butte Swamp.

An evaporite salt bearing formation occurs at depth; (Potlatch Anhydrite, Mudge 1983), however the salt appears to have been removed in the geologic past and the evaporite bed produces little dissolved salts (Marshall 1983). Past exploratory drilling along the Front has produced little fresh and/or salt water. Present production from the Knowlton structure produces very little groundwater. Williams Exploration indicates that very little water has been separated from the gas produced at Blackleaf Canyon from the Knowlton structure thus far. Wexpro, drilling just north of the Teton River, indicates that the Potlatch Anhydrite was the only evaporite facies they encountered and that they would not expect saltwater production in conjunction with petroleum production on their Pamburn Creek prospect (Marshall 1983).



RECREATION

Deer and elk hunting are the major recreation activities in the EIS area. Approximately 95 percent of the recreation use occurs during the big game season or from October 20 to December 1 of each year.

There are fewer recreation opportunities on private land than on public lands, which is increasing the recreational use of these public lands.

The Blackleaf Wildlife Management Area has also increased the visitor use of the area and has contributed to a major increase in use during the fall hunting season.

The Blackleaf Road accesses the National Forest for less than 1/8 mile. This starts at the Forest boundary and ends at the Blackleaf Trailhead No. 106, consisting of toilet and unloading facilities. No campground or picnic facilities exist, but this trail does provide access to the Bob Marshall Wilderness and the North Fork of the Teton River.

Cross county skiing is becoming more important in the area, but will not become a major activity due to the lack of access and inadequate snow depth caused by the severe winds. For this same reason, snowmobiling will remain a minor activity in the EIS area.

Some portions of the EIS area provide near wilderness characteristics for those seeking that type of recreational experience. These areas are somewhat remote; nearly roadless; provide rugged topography; present good opportunities for exploring; require a degree of self reliance; and are relatively free of human influence.

A portion of the EIS area, the Teton Roadless Area lies adjacent to the Bob Marshall Wilderness Area and was studied for possible inclusion inclusion in the National Wilderness Preservation System. However, none of this 17,603 acre area was recommended as suitable for wilderness management.

VISUAL RESOURCES
(Issue: Visual Quality)

The EIS area is located between two major geographic regions. The eastern 1/2 of the area is located within the Rocky Mountain Foreland character type, found at and near the eastern foot of the Rocky Mountains; extending from the Blackfeet Reservation south and eastward in southcentral Montana. This subregion includes a variety of land features including plateau surfaces, buttes and an expansive area of prairie and cultivated land. The western 1/2 of the EIS area is located within the Columbia Rockies character type. As the name implies, the area is mountainous terrain separated by valleys that vary from rocky gorges through narrow, crooked, stream-cut valleys to broad, straight structured valleys. The mountain range and valleys are generally aligned in a north-northwest to south-southeast direction.

There are two major processes involved in managing visual resources in this area. One is the scenic quality of the area. This is expressed in the following way:

Class A = Distinctive (USFS) Outstanding (BLM)
Class B = Common (USFS) Above Average (BLM)
Class C = Minimal (USFS) Common (BLM)

The scenic quality of an area is influenced by the agencies' management objectives for that region. These objectives are called Visual Quality Objectives by the Forest Service and Visual Resource Management Objectives by the BLM. The objectives for each agency are:

Class I (BLM) = Preservation/Retention (USFS)
Class II (BLM) = Unnoticed (USFS)
Class III (BLM) = Minor Disturbance/Partial Retention (USFS)
Class IV (BLM) = Disturbance/Modification (USFS)

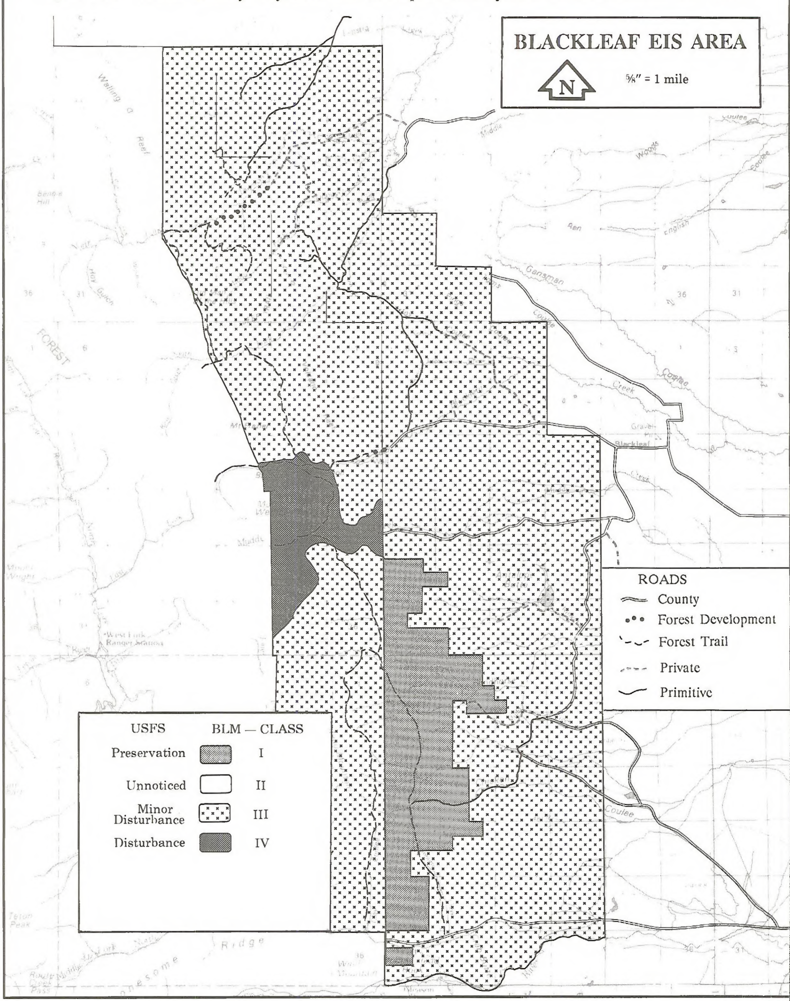
The majority of the scenery in the EIS area falls within Class B (Common) and Class C (Minimal) Scenic Qualities Ratings as defined by the National Forest Visual Management System. Those portions of the EIS area that are Class B and are in the background view from the highway would have a Visual Quality Objective of Minor Disturbance (Partial Retention). This means that management activities should remain visually subordinate to the characteristic landscapes and that production facilities should be screened from view by vegetation or topography. The remaining portion of the EIS area would have a Visual Quality Objective of Modification. Under this objective, management activities may alter the original appearing landscape. Alterations should borrow from naturally established form, line, color and texture so visual characteristics are those of natural occurrences within the surrounding area.

About 1/3 of the western portion of the planning unit is in a Class A (Distinctive) scenic quality area. Portions of the EIS area are located in the background view from Highway 89 and the visual quality objective for variety Class A would be Preservation (retention). This means that management activities should not be visually evident.

The majority of the EIS area has an existing Visual Quality Objective Rating (USFS system) of Minor Disturbance, reflecting the undeveloped nature of the area (see Figure 3.19). This means changes in the landscape are noticed by the average person, but do not attract attention. The natural appearance of the landscape still remains dominant.

The Visual Absorption Capability (VAC) of the area ranges from low to high. An opportunity exists to alleviate visual impacts in areas that have medium to high visual absorption capabilities.

Figure 3.19 Visual Quality Objective and Transportation System in the Blackleaf EIS Area.



NOISE

(Issues: Wildlife, Recreation)

The existing sound environment is characterized by natural sounds (e.g., water flow in streams, wind, etc.) and modified by intermittent sounds from vehicles passing on roads and human activities in recreational areas.

Existing sound levels in the EIS area were measured during July and August 1983, in the Chicken Coulee and Antelope Butte areas. These data were used to estimate average day/night sound levels using the A-weighted decibel scale.

Estimated day/night ambient sound levels ranged from a low of 25 dBA in Chicken Coulee to a high of 55.5 dBA near Antelope Butte in a high wind situation. The overall ambient noise levels average 40 dBA. Comparing these ambient sound levels with other familiar sounds (see Figure 3.20) suggests a quiet environment throughout the EIS area. Figure 3.20 also shows how oil and gas related development sounds would compare.

Figure 3.20 Noise Level Comparison Chart.

NOISE LEVEL, IN DECIBELS	HOW IT FEELS	EQUIVALENT SOUNDS	HOW IT SOUNDS (Compared to 75dB(A))	SOUNDS FROM DRILLING OPERATION
140	Near permanent damage to ears	Jackhammer Chainsaw Firecracker at 15FT	64 times as loud	
130	Pain to ears	Rock and roll band	32 times as loud	
120	Uncomfortably loud	Unmuffled motorbike at 2-3FT Car horn	16 times as loud	
110	Discomfort threshold	Unmuffled cycle at 25FT	8 times as loud	
100	Very loud Conversation stops	Garbage trucks and city buses Power lawnmover	4 times as loud	Typical pipeline compressor station at 50FT
90	Intolerable for phone use	Steady flow of freeway traffic Garbage disposal	2 times as loud	Oilfield access road as trucks pass at 25FT
80	Extra auditory physiological effects	Automatic dishwasher Passenger car 65 mph at 25 FT Busy downtown area	75dB(A)	Drilling rig at 200 feet from drill hole
70			1/2 as loud	Typical oil pump jack at 100 feet (Natural gas powered)
60	Quiet	Normal conversation	1/4 as loud	
50	Sleep interference		1/8 as loud	
40			1/6 as loud	Drilling rig at 1/2 mile from drill hole
30		In a quiet house at midnight		Ambient sound levels in the area of concern
20				
10				
0				

Source: Modified from the Federal Energy Regulatory Commission (FERC) Final EIS on Trailblazer Pipeline System FERC/EIS-0018 Docket No. OP79-80 et al.

TRANSPORTATION SYSTEM
(Issue: Oil and Gas Operations)

The primary access routes to the EIS area include U.S. Highway 89, the Forest Service's Teton Road No. 144 and several state and county maintained routes.

The transportation system within the EIS area consists of developed roads (35.5 miles), primitive roads (37.8 miles) and single track trails (25.1 miles). Table 3.3 shows which agency or level of government has jurisdiction over various sections of these roads and trails.

TABLE 3.3

TABLE OF ACCESS SYSTEMS AND JURISDICTION[1]

Type of System	Number of Miles	Jurisdiction
Developed Roads	5.8 miles	United States Forest Service
	29.7 miles	State or County
Total	35.5 miles	
Primitive Roads	3.3 miles	State of Montana
	31.7 miles	Private Ownership
	2.8 miles	Bureau of Land Management
Total	37.8 miles	
Trails	18.7 miles	United States Forest Service
	3.2 miles	Private Ownership
	3.2 miles	Bureau of Land Management
Total	25.1 miles	

[1]BLM/USFS, 1989

Special restrictions govern vehicle travel inside the EIS area. Vehicle traffic on the Lewis & Clark National Forest is managed under the Forest Travel Plan. This plan restricts off-road vehicle (ORV) travel to designated routes in the forest and prohibits off road travel by class of vehicle. Motorcycle and snowmobile use has not been restricted inside the forest boundary, unless site-specific conditions dictate restrictions.

Bureau of Land Management lands are closed under the Blind Horse ONA management guidelines which prohibit motorized vehicle use (Rocky Mountain Front ONA Activity Plan Environmental Assessment 1989).

State of Montana lands are generally contained in the Blackleaf Wildlife Management area and off road vehicle use is restricted during seasonal periods for wildlife purposes.

ECONOMIC AND SOCIAL CONDITIONS

Three zones (local, regional and Montana) were used in this description. The local area is defined as Teton County or the area where people's lifestyles are most likely to be affected. The regional zone includes Cascade, Glacier, Lewis and Clark, Pondera, and Teton Counties. This area is defined on the basis of the labor market of the area and includes communities within a 60 mile commuting distance to the Blackleaf EIS area. State of Montana is used for comparison purposes.

Population Characteristics

The population of the regional area was 150,100 in 1986 (18 percent of Montana's total population). This is an 8-percent increase from 1970 compared to an 18-percent increase for the State of Montana. Between 1970 and 1986, the regional area grew at a slower rate than the trend in Montana. Some counties and communities experienced significant changes in population from 1970 to 1988. Lewis and Clark County grew more rapidly than the state with an increase in population of 41 percent while the communities of Browning, Cut Bank and Fairfield had decreases in population between 1970 and 1986. Although the 1986 census estimate for Browning was 1,280, about 3,000 to 4,000 people are considered to comprise the surrounding community (see Tables 3.4 and 3.5).

Between 1986 and 1988, the regional area experienced a decline in population similar to the trend for Montana's total population. Only Lewis and Clark County had an increase in population (7.3 percent), compared with an overall decline of 1.7 percent for the state. For the local area, Teton County's population grew by 4 percent between 1970 and 1986, but between 1986 and 1988, the county's population decreased by 4.6 percent, finally to a level below 1970 (see Tables 3.4 and 3.5).

The largest community within 60 miles of the Blackleaf EIS area is Cut Bank, with a 1986 population of 3,750. Other towns within 60 miles include Browning (1986 population 1,280), Conrad (2,880), Valier (670), Choteau (1,850), Dutton (410) and Fairfield (600). Another 19 unincorporated communities are within 60 miles of the Blackleaf EIS area. Two of the unincorporated communities, Dupuyer and Bynum, are within 20 miles of the Blackleaf EIS area. Tables 3.4 and 3.5 show a comparison of 1986 population characteristics with 1970 and 1980 for counties and selected communities in the regional area.

Within the area, Teton County is lacking some basic services; the number of physicians per person is lower, education levels are slightly lower, the proportion of housing lacking some or all plumbing is higher, mean family income is lower and the proportion of families below the national poverty level is high. Positive factors include the county's remoteness and sparse population which result in freedom from many urban problems, such as high crime rates and overcrowding.

TABLE 3.4

POPULATION CHARACTERISTICS FOR THE REGIONAL AREA AND MONTANA, 1970, 1980, 1986 AND 1988[1]

Community	1970	1980	% Change 1970-1980	1986	% Change 1980-1986	1988	% Change 1986-1988
Cascade County	81,804	80,696	-1.4	79,400	-1.6	78,200	-1.5
Glacier County	10,783	10,628	-1.4	11,200	5.4	11,100	-.8
Lewis and Clark County	33,281	43,039	29.3	46,400	7.8	47,000	1.3
Pondera County	6,116	6,731	1.8	6,700	- .5	6,700	No Change
Teton County	6,116	6,491	6.1	6,400	-1.4	6,100	-4.6
Regional Area	138,595	147,585	6.5	150,100	1.7	149,100	-.5
Montana	694,409	786,690	13.3	819,000	4.1	805,000	-1.7

[1]1970 Census of Population, Characteristics of the Population, part 28, Montana.
U.S. Bureau of Census, 1987.
Bureau of Business and Economic Research, University of Montana

TABLE 3.5

POPULATION FOR SELECTED COMMUNITIES WITHIN THE REGIONAL AREA, 1970, 1980 AND 1986[1]

Community	1970	1980	%Change 1970-1980	1986	%Change 1980-1986
Browning	1,700	1,226	-27.9	1,280	4.6
Cut Bank	4,004	3,688	- 7.9	3,750	1.6
Conrad	2,770	3,074	11.0	2,880	-6.2
Valier	651	640	- 1.7	670	5.2
Choteau	1,586	1,798	13.4	1,850	2.8
Dutton	1,586	359	13.5	410	15.0
Fairfield	638	650	1.9	600	-7.4

[1]1980 Census of Population and Housing, Advance Reports Final Population and Housing Unit Counts PHC80-V-28, Montana.
U.S. Bureau of the Census, 1987.

These indicators are simply an inference and are not meant to be a direct measurement of social well-being or all encompassing. It should be pointed out that even if particular statistics show poor social well-being, the residents may not perceive their situation as such. Location and lifestyle may be more important to local residents than some other economic or social indicators of well-being.

Projected population levels through the year 2005 are displayed in Tables 3.6 and 3.7 for counties and selected communities in the regional area.

TABLE 3.6

PROJECTED POPULATION AND EMPLOYMENT LEVELS THROUGH THE YEAR 2005 FOR COUNTIES IN THE REGIONAL AREA[1]

County	Year	POPULATION Total	POPULATION Change	POPULATION Percent	EMPLOYMENT Total	EMPLOYMENT Change	EMPLOYMENT Percent
CASCADE COUNTY	1990	89580			34972		
	1995	93778	4197	4	36261	1288	3
	2000	97254	3475	3	37606	1344	3
	2005	100825	3571	3	38988	1382	3
GLACIER COUNTY	1990	11948			4591		
	1995	12388	440	3	4760	169	3
	2000	12848	459	3	4936	176	3
	2005	13319	471	3	5118	181	3
LEWIS & CLARK COUNTY	1990	50166			24696		
	1995	54272	4106	8	26734	2038	8
	2000	58275	4002	7	28720	1985	7
	2005	62181	3906	6	30658	1938	6
PONDERA COUNTY	1990	7369			3071		
	1995	7710	341	4	3184	113	3
	2000	8067	357	4	3302	118	3
	2005	8394	326	4	3424	121	3
TETON COUNTY	1990	6973			2781		
	1995	7228	254	3	2883	102	3
	2000	7492	263	3	2990	106	3
	2005	7766	273	3	3100	109	3

[1]Population and employment were estimated using coefficients from the Montana BLM Economic/Demographic Model.

TABLE 3.7

CURRENT AND PROJECTED POPULATION AND EMPLOYMENT LEVELS THROUGH THE YEAR 2005 FOR SELECTED COMMUNITIES IN THE REGIONAL AREA[1]

	POPULATION			EMPLOYMENT		
Year	Total	Change	Percent	Total	Change	Percent
CUT BANK						
1990	4138			1813		
1995	4288	149	3	1880	66	3
2000	4447	159	3	1950	69	3
2005	4611	163	3	2022	71	3
BROWNING						
1990	1380			587		
1995	1432	52	3	609	21	3
2000	1485	52	3	632	22	3
2005	1540	54	3	655	23	3
CONRAD						
1990	3365			1411		
1995	3521	155	4	1463	52	3
2000	3684	163	4	1518	54	3
2005	3838	154	4	1574	55	3
VALIER						
1990	700			328		
1995	733	32	4	340	12	3
2000	767	33	4	352	12	3
2005	796	29	3	365	12	3
CHOTEAU						
1990	1931			725		
1995	2002	70	3	752	26	3
2000	2075	73	3	780	27	3
2005	2151	75	3	809	28	3
DUTTON						
1990	385			156		
1995	399	14	3	161	5	3
2000	414	14	3	167	6	3
2005	429	15	3	173	6	3
FAIRFIELD						
1990	698			254		
1995	723	25	3	263	9	3
2000	750	26	3	273	9	3
2005	777	27	3	283	10	3

[1]Population and employment were estimated using coefficients from the Montana BLM Economic/Demographic Model.

Regional Economy

Like Montana, the regional area derives its economic strength from natural resources. These resources include the land which is used for crop and livestock production, oil and gas production, and water and wildlife that offer outdoor recreation opportunities. Most of the area's employment, personal income and business activity is derived from the utilization of natural resources.

A description of the oil and gas extraction and tourism industries is given below. Whenever possible, production data is given for each industry to indicate historic output levels and the relative contribution of each industry to the economic base of the region.

The oil and gas industry has been present in Montana since the early 1900s and is an important basic industry providing 4,200 jobs (1 percent of the total employment) and $122 million in earnings (2 percent of the total earnings) for Montana workers in 1984.

Employment in the oil and gas industry is down substantially from its peak of 6,825 workers in 1981. In 1987, 9 percent of Montana's total gas production and 7 percent of the total oil production was from the regional area. Natural gas production in Teton County increased significantly from 1982 to 1984. Production increased 178 percent from 1982 to 1983 and another 97 percent in 1984. However, production declined 23 percent in 1985, 25 percent in 1986, and another 75 percent in 1987. Tables 3.8 and 3.9 show oil and gas production by county for the regional area during the years 1978 through 1987.

TABLE 3.8

GAS PRODUCTION FOR THE REGIONAL ZONE OF INFLUENCE
1978-1985 (MCF)[1]

Year	Cascade	Glacier	Lewis and Clark	Pondera	Teton	Regional Area	Montana
1987	0	3,146,248	0	610,883	290,441	4,047,572	44,537,103
1986	0	3,797,212	0	631,242	1,149,336	5,577,790	43,657,231
1985	0	3,886,084	0	725,002	1,525,644	6,136,730	45,871,819
1984	0	3,062,034	0	832,440	1,970,821	5,865,295	48,499,939
1983	0	3,574,831	0	1,142,945	1,002,135	5,719,911	46,422,761
1982	0	3,101,586	0	1,056,651	360,779	4,519,016	48,337,829
1981	0	2,070,592	0	1,676,078	452,373	4,199,043	48,654,456
1980	0	2,491,281	0	2,187,099	473,273	5,151,653	53,520,370
1979	0	2,069,082	0	1,386,927	111,644	3,567,653	54,969,129
1978	0	3,574,291	0	447,891	96,730	4,118,912	46,758,635

[1]Reports of the State Department of Revenue July 1, 1978 to June 30, 1988, and unpublished data.

TABLE 3.9

OIL PRODUCTION FOR THE REGIONAL ZONE OF INFLUENCE
1978-1987 (Bb1)[1]

Year	Cascade	Glacier	Lewis and Clark	Pondera	Teton	Regional Area	Montana
1987	0	1,310,376	0	332,604	129,361	1,772,341	24,225,665
1986	0	1,339,391	0	361,336	142,730	1,843,457	26,326,916
1985	0	1,389,902	0	379,992	138,013	1,907,907	30,284,836
1984	0	1,395,188	0	403,083	158,637	1,956,908	30,668,305
1983	0	1,392,774	0	433,888	142,861	1,969,523	29,320,419
1982	0	1,463,621	0	460,894	136,850	2,061,365	30,937,514
1981	0	1,585,969	0	363,732	125,014	2,074,715	30,517,947
1980	0	1,513,865	0	306,137	467,399	2,287,401	29,927,468
1979	0	1,524,016	0	288,301	129,293	1,941,610	30,285,631
1978	0	1,612,372	0	377,743	391,763	2,381,878	30,934,923

[1]Reports of the State Department of Revenue July 1, 1978 to June 30, 1988.

It is estimated that the oil and gas extraction sector provides most of the 656 mining jobs and $10 million in earnings in the regional area or 1 percent of the total employment and earnings for 1986 (see Tables 3.10 and 3.11).

Evaluating the tourism industry is difficult because data are often unavailable and this industry's employment and income earnings cut across many other industry sectors. The major factor when evaluating this industry is the expenditures of the nonresident travelers and tourists.

Nonresident travel in Montana was estimated at 2.2 million visitors in 1983 with expenditures at $423 million (Montana Department of Commerce, 1985). This spending supported about 10,500 jobs and created $106 million in earnings for Montana workers. This is about 3 and 2 percent of the state employment and income earnings respectively. The majority of travel and tourism expenditures occurs in relatively few Montana counties (see Table 3.12).

Three of the top 10 counties are located in the regional zone of influence and Cascade, Glacier, and Lewis & Clark Counties account for 21 percent of the employment from travel and tourism in Montana.

Recreation use in the Blackleaf EIS area is estimated at 450 recreation visitor days annually. Recreationists using these public lands spend an estimated $20,000 each year. These expenditures represent direct payments to sporting goods stores, motels, service stations, and other services. As recreation expenditures circulate through the economy, an estimated $37,000 will occur in business activity with $11,000 in earnings, and the equivalent of one job in the retail trade and service sector.

TABLE 3.10

MINING EMPLOYMENT IN THE REGIONAL AREA 1982-1986[1]

Year	Cascade	Glacier	Lewis and Clark	Pondera	Teton	Regional Area
1986	102	353	103	61	37	656
1985	98	432	87	56	32	705
1984	89	452	127	54	(D)	722
1983	96	422	126	45	74	763
1982	82	498	102	44	186	912

(D) Not shown to avoid disclosure of confidential information. Not included in total.

[1]Bureau of Economic Analysis, U.S. Dept. of Commerce, Regional Economic Information System, 1988.

TABLE 3.11

MINING EARNINGS IN THE REGIONAL AREA 1982-1986 (Thousands of 1986 Dollars)[1]

Year	Cascade	Glacier	Lewis and Clark	Pondera	Teton	Regional Area
1986	1,995	5,136	1,315	944	626	10,016
1985	2,658	8,620	1,803	837	673	14,591
1984	2,261	9,564	2,243	782	(D)	14,850
1983	2,405	8,900	2,617	658	2,158	16,738
1982	2,806	11,377	2,296	717	4,231	21,427

(D) Not shown to avoid disclosure of confidential information. Not included in total.

[1]Bureau of Economic Analysis, U.S. Dept. of Commerce, Regional Economic Information System, 1988.

TABLE 3.12

CONCENTRATION OF TRAVEL-RELATED EMPLOYMENT AND EARNINGS IN MONTANA COUNTIES, 1983[1]

County	Employment Number of Workers	Earnings ($1,000)
Yellowstone	1,575	15,900
Gallatin	1,155	11,660
Flathead	1,155	11,660
Cascade	945	9,540
Silver Bow	735	7,420
Missoula	735	7,420
Glacier	735	7,420
Lewis and Clark	525	5,300
Park	315	3,180
Dawson	315	3,180

[1]Montana Department of Commerce, 1985

Employment

Figures for 1982 and 1986 show services, government and retail trade to be the main sources of employment in the regional area. Those three sectors of the economy account for 68 percent of the 1986 total employment. During 1986, 17 percent of the work force was employed in the retail trade sector, 27 percent in services and 24 percent in government. Total employment increased 5 percent from 1982 to 1986. During this same period employment in Montana increased by 1 percent. While total employment increased some sectors of the economy experienced significant changes. Mining employment decreased 28 percent and wholesale trade decreased 17 percent (see Table 3.13).

Employment in Teton County was relatively stable from 1982 to 1986, increasing by only 2 percent. Although employment remained relatively stable there were significant shifts in employment between sectors of the economy. Employment in mining decreased 80 percent and wholesale trade decreased 14 percent while employment in agricultural services, finance and other services increased (see Table 3.14).

Projected employment levels through the year 2005 are displayed in Tables 3.6 and 3.7 for counties and selected communities in the regional area.

TABLE 3.13

EMPLOYMENT BY TYPE AND BROAD INDUSTRIAL SOURCE FOR THE REGIONAL AREA 1982-1986[1]

Industry	1982	% of Total	1986	% of Total	% Change 1982-1986
Farm	3,839	5	3,793	5	-1
Agr. Ser., For., Fish	443	1	575	1	30
Mining	912	1	656	1	-28
Construction	3,434	4	3,750	5	9
Manufacturing	2,858	4	2,622	3	-8
Trans. and Pub. Utilities	4,523	6	4,215	5	-7
Wholesale Trade	4,249	5	3,542	4	-17
Retail Trade	13,576	17	14,239	17	5
Fin., Ins. and Real Est.	6,078	8	6,610	8	9
Services	19,309	25	22,287	27	15
Government	18,645	24	19,253	24	3
Total	77,866		81,542		5

[1]Bureau of Economic Analysis, U. S. Dept. of Commerce, Regional Economic Information System, 1988.

TABLE 3.14

EMPLOYMENT BY TYPE AND BROAD INDUSTRIAL SOURCE FOR TETON COUNTY 1982-1986[1]

Industry	1982	% of Total	1986	% of Total	% Change 1982-1986
Farm	869	28	863	29	-1
Agr. Ser., For., Fish	55	2	76	3	38
Mining	186	6	37	1	-80
Construction	142	5	133	4	-6
Manufacturing	60	2	59	2	-2
Trans. and Pub. Utilities	192	6	177	6	-8
Wholesale Trade	150	5	129	4	-14
Retail Trade	344	11	342	11	-1
Fin., Ins. and Real Est.	168	5	195	6	16
Services	451	15	549	18	22
Government	459	15	4,643	15	1
Total	3,076		3,024		-2

[1]Bureau of Economic Analysis, U. S. Dept. of Commerce, Regional Economic Information System, 1988.

Earnings

Table 3.15 shows the regional area's earnings by source for 1982 and 1986. In 1986, government contributed 28 percent of the regional area's total earnings while services contributed another 24 percent. Government is the major source of earnings with services and retail trade contributing the next largest portions. Total earnings were 1 percent higher in 1986 than in 1982. During this same period, total earnings in Montana decreased by 9 percent.

Table 3.16 shows Teton County's earnings by source for 1982 and 1986. In Teton County farming and government were the major source of earnings in 1986, with transportation/public utilities and services contributing the next largest portions. Total earnings were 9 percent higher in 1986 than in 1982.

TABLE 3.15

EARNINGS BY BROAD INDUSTRIAL SOURCE FOR 1982-1986 THE REGIONAL AREA (Thousands of 1986 Dollars)[1]

Industry	1982	% of Total	1986	% of Total	% Change 1982-1986
Farm	38,350	3	54,708	4	43
Agr. Ser., For., Fish	4,585	0	5,128	0	12
Mining	21,427	2	10,016	1	-53
Construction	80,841	6	81,956	6	1
Manufacturing	67,164	5	58,032	4	-14
Trans. and Pub. Utilities	130,837	10	109,901	8	-16
Wholesale Trade	100,200	8	80,416	6	-20
Retail Trade	155,201	12	155,034	12	0
Fin., Ins. and Real Est.	78,568	6	85,319	6	9
Services	280,059	21	315,307	24	13
Government	367,258	28	379,699	28	3
Total	1,324,490		1,335,516		1

[1]Bureau of Economic Analysis, U. S. Dept. of Commerce, Regional Economic Information System, 1988.

TABLE 3.16

EARNINGS BY BROAD INDUSTRIAL SOURCE FOR TETON COUNTY
1982-1986 (Thousands of 1986 Dollars)[1]

Industry	1982	% of Total	1986	% of Total	% Change 1982-1986
Farm	8,065	20	15,063	35	87
Agr. Ser., For., Fish	467	1	635	1	36
Mining	4,231	11	626	1	-85
Construction	2,382	6	2,374	5	0
Manufacturing	742	2	640	1	-14
Trans. and Pub. Utilities	5,229	13	4,936	11	-6
Wholesale Trade	3,038	8	2,754	6	-9
Retail Trade	3,136	8	2,687	6	-14
Fin., Ins. and Real Est.	1,691	4	1,671	4	-1
Services	4,141	10	4,846	11	17
Government	6,535	16	7,099	16	9
Total	39,657		43,331		9

[1]Bureau of Economic Analysis, U. S. Dept. of Commerce, Regional Economic Information System, 1988.

Public Finance

Table 3.17 shows the 1988 total taxable valuation and taxes levied by county for the regional area. Cascade County, with Great Falls serving as a major trade and service center, has the highest taxable valuation and one of the highest average mill levies. Teton County has the lowest taxable valuation and also maintains a low average mill levy due to the small population and rural setting.

Net proceeds from oil and gas production accounted for 9 percent of the total taxable valuation for the five counties and varied from zero for Cascade and Lewis & Clark Counties to 45 percent for Glacier County (see Table 3.18). Property tax assessment on agricultural land and equipment accounted for 13 percent of the total taxable valuation and varied from 4 percent for Lewis and Clark County to 47 percent for Teton County (see Table 3.18).

Montana imposes four taxes on natural gas production; the resource indemnity trust tax, gas producers privilege and license tax, natural gas severance tax and net proceeds tax.

The resource indemnity trust tax is an annual tax for all firms engaged in extracting minerals. The tax collections are deposited in a trust fund to protect the state against loss or damage to the environment. The interest from the trust is used to develop Montana's water resources and to fund other projects to improve the environment.

The oil and gas producers privilege and license tax is a quarterly tax on all oil or natural gas produced, stored or marketed within the state. The tax collections fund the operations of the Board of Oil and Gas Conservation.

Natural gas produced from within Montana is subject to a severance tax of 2.65 percent of the total gross value. Gross value of natural gas is determined by taking the total cubic feet produced each month of the year at the average value at the wellhead. However, government royalties are exempt from the tax. Natural gas severance taxes are allocated to local governments and the state general fund. All natural gas produced from a well 5,000 feet deep or deeper, which is drilled between December 31, 1976 and December 31, 1992, is exempt from all severance tax for 3 years, providing the gas is placed in a distribution system serving chiefly Montana consumers.

The largest tax on natural gas is the net proceeds tax imposed for local governments. The tax is calculated on the gross value of natural gas, minus all allowable deductions, multiplied by the local mill levy. Half the net proceeds from a gas well are exempt from the net proceeds tax for 3 years, if produced from a well 5,000 feet deep or deeper and drilling was commenced after December 31, 1976 and before December 31, 1992, providing the gas is placed in a distribution system serving chiefly Montana consumers.

Table 3.19 shows the taxes generated from natural gas production within Montana in recent years:

TABLE 3.17

TOTAL TAXABLE VALUATION AND TAXES LEVIED FOR 1988 BY COUNTY[1]

County	Total Taxable Valuation	Taxes Levied					Mills*
		State	County	Schools	Other	Total	
Cascade	90,299,276	541,983	7,158,033	21,718,786	7,574,180	36,992,982	409.67
Glacier	33,222,585	199,429	2,067,988	5,188,315	651,794	8,107,526	244.04
Lewis and Clark	66,449,765	398,545	5,073,061	10,856,839	8,238,714	24,567,159	369.71
Pondera	17,984,009	107,907	1,555,949	2,779,767	777,678	5,221,301	290.33
Teton	16,032,023	95,714	1,236,719	2,595,464	1,469,738	5,397,635	336.68

*Average mill levy based on total taxes levied and total taxable valuation.

[1]Report of the State Department of Revenue for the Period July 1, 1986 to June 30, 1988.

TABLE 3.18

TOTAL, OIL, GAS, AND AGRICULTURAL TAXABLE VALUATION FOR COUNTIES IN THE REGIONAL AREA, 1988[1]

County	Total	Oil and Gas	% of Total	Agricultural	% of Total
Cascade	90,299,276	0	—	6,605,688	7
Glacier	33,222,585	15,048,034	45	4,442,052	13
Lewis and Clark	66,449,765	0	—	2,340,983	4
Pondera	17,984,009	3,231,977	18	7,127,068	40
Teton	16,032,023	1,126,044	7	7,549,524	47

[1]Report of the State Department of Revenue for the Period July 1, 1986 to June 30, 1988.

TABLE 3.19

NATURAL GAS PRODUCTION TAXES[1]

Fiscal or Calendar Year	Fiscal Year		Calendar Year
	Resource Indemnity Trust Tax	Severance Tax	Net Proceeds
1987	538,251	2,492,465	
1986	583,961	2,890,666	14,253,000
1985	627,504	2,945,778	14,772,000
1984	589,348	2,797,996	14,775,765
1983	537,871	2,649,726	14,202,097
1982	491,092	2,659,811	11,976,791
1981	446,778	2,116,291	10,830,283
1980	371,386	1,264,025	9,554,124
1979	319,377	1,151,103	7,793,175
1978	189,214	923,600	4,856,033

[1]Reports of the State Department of Revenue July 1, 1978 to June 30, 1988, and unpublished data.

Social Conditions

Social conditions, while difficult to measure directly, can be inferred from a variety of secondary indicators. It has been found that changes in such economic indicators as rate of population growth, per capita income, and general level of unemployment, as well as such social indicators as rates of crime, divorce, and infant mortality can be used to describe generally changes in area social conditions.

Table 3.20 presents indicators of social well-being for counties in the regional area. These indicators present a mixed picture, suggesting that portions of the area have both the positive and negative factors associated with remote rural areas. When comparing the area to Montana; the area rates higher in the positive factors and lower in the negative factors. The area education levels are higher, unemployment rate is lower, mean family income is higher and the proportion of families below the national poverty level is lower.

TABLE 3.20
INDICATORS OF SOCIAL WELL-BEING[1]

	Year	Cascade	Glacier	Lewis and Clark	Pondera	Teton	Regional Area	Montana
Physicians Per 100,000 Population	1984	193.1	53.0	220.5	70.4	46.8	178.9	153.6
	1980	163.6	65.9	174.3	74.3	77.0	151.8	133.5
Crime Rate Per 1,000 Population	1983	68.7	N/A	60.7	9.9	9.4	60.5	42.8
	1979	72.2	19.1	64.9	10.1	9.7	63.4	45.3
Per Capita Income	1980	6,959	5,362	7,264	6,661	6,070	6,880	6,596
	1970	2,864	2,119	3,261	2,463	2,819	2,880	2,712
Families With Income Below the Poverty Level %	1979	8.1	16.7	6.2	10.8	11.4	8.4	9.2
	1969	8.3	23.4	6.5	14.2	10.9	9.4	10.4
High School Graduates, Percent of Population Over 24								
Total	1980	75.2	67.9	82.3	68.7	67.4	76.1	74.4
Total	1970	65.3	50.1	69.6	55.4	53.0	64.1	59.2
Native American	1980	46.1	59.4	54.3	N/A	31.8	54.2	56.0
Unemployment Rate, Percent of Civilian Labor Force								
Total	1980	7.8	8.6	5.1	6.2	4.7	6.8	8.3
Total	1970	6.5	12.6	4.9	3.2	4.2	6.2	6.3
Native American	1980	21.4	14.2	6.8	N/A	15.2	15.7	20.1
Mean Family Income								
Total	1979	21,373	18,430	22,301	21,890	18,971	21,347	20,679
Total	1969	10,137	8,353	11,378	8,800	9,985	10,227	7,846
Native American	1979	12,538	14,118	14,081	N/A	N/A	13,596	14,101
Year-Round Housing Units With No Bath or Only Half Bath, %	1980	3.3	5.6	2.5	4.9	6.8	3.4	4.0
Year-Round Housing Units With No Complete Kitchen Facilities, %	1980	1.7	4.6	1.7	6.0	6.0	2.3	3.0

N/A = Data Not Available

[1]County Profiles, Census of Economic and Information Center, Helena, Montana.

1980 Census of Population and Housing, Advance Estimates of Social, Economic, and Housing Characteristics, Montana

1970 Census of Population, Characteristics of the Population, Montana

These indicators have changed from 1970 to 1980 and show that overall the area's standard of living has improved. The number of physicians per person increased slightly from 1970 to 1980, the percentage of families with income below the poverty level has decreased and education levels are higher. At the same time per capita income increased 23% and mean family income increased 9% (adjusted for inflation). This compares with a 20% increase in per capita income and a 28% increase in mean family income for Montana during the same time period.

INTRODUCTION

This chapter identifies the physical, biological, social and economic impacts of implementing the alternatives described in Chapter 2 and is organized by resource component for the reader's convenience.

AIR QUALITY

Depending on the intensity of oil and gas development, general air quality impacts could result from:

1. Exhaust from drilling rig engines.
2. Exhaust from vehicular travel to and from the sites.
3. Fugitive dust from traffic on access roads.
4. Gases encountered during drilling operations which could be released through the mud system.
5. Emissions from producing wellsite processing facilities (heater/treaters, tanks, flares, etc.).
6. Emissions from the central gas processing plant to be located in Sec. 8, T. 26 N., R. 8 W.
7. Emissions from possible pipeline ruptures.

These air quality impacts were considered in all of the following alternative discussions.

Alternative 1

Under this alternative, the two producing wells and two wells shut in, but capable of production would be brought online and a central gas processing facility constructed. These activities would create no significant air quality impacts.

The central gas processing facility would create no air quality impacts as it is proposed as a nonpolluting closed system (see Appendix D). A State of Montana air quality permit would be required prior to construction of the facility, but no federal permit would be necessary.

Alternative 2

Drilling operations would result in minor, short-term impacts to air quality as one to three drilling rigs operate in the area. The impacts to air quality would increase due to a minor increase of various fugitive gases escaping at on-site wellheads. These impacts would not approach federal or state standards.

Alternative 3

The impacts of drilling operations would be similar to those described in Alternative 2, but fewer because of fewer wellsites.

The gas processing facility discussed in Alternative 1 and in Appendix D would also apply to this alternative.

Alternative 4

Again, the impacts of drilling operations would be similar to those described in Alternative 2.

The gas processing facility discussed in Alternative 1 and in Appendix D would also apply to this alternative.

PALEONTOLOGY

Alternative 1

Pipeline construction and trenching through fossil rich areas would disturb the context in which fossils were found. However, this would be offset by the actual exposure and location of the fossils. The overall impact could be of a positive nature; possibly leading to new discoveries and additional knowledge. Collectors and rock hounds could gather some of these fossils which would be a loss in a scientific sense, but a gain in the recreation and commercial areas.

Table 4.1 shows the types of fossils that could be impacts by each alternative.

Alternative 2

The impacts to paleontological resources would be similar to those discussed in Alternative 1. However, the potential for impacts would increase because of the additional roads, pipelines and wellsites.

Table 4.1 lists fossils and fossil evidence that could be disturbed and/or impacted by this alternative. The only type of fossil in the significant category (as defined in Chapter 3) are dinosaur remains which could be impacted by drill site E-4. The context and association of recent, nearby discoveries were very important in establishing certain social characteristics and behaviors of dinosaurs (Horner 1984).

Alternative 3

The impacts of this alternative would be proportionally the same as those in Alternative 2. Again the E-4 wellsite would have the potential to impact dinosaur fossils, which would be described as a significant impact (see Table 4.1).

Alternative 4

The impacts of this alternative would be the same as those described in Alternative 2 (see Table 4.1).

TABLE 4.1 PALEONTOLOGICAL EFFECTS[1] ALTERNATIVE 1

Drill Site	Gastropods (snails)	Pelecypods (clam like)	Coquina (Broken shells, corals and organic debris)	Corals Brachiopods (clam like)	Belemnites (remains of squid-like animal, cigar (shaped)	Ammonities (chambered nautilus)	Dinosaur bones	Organic trails and burrows, wood and leaf fragments
Alternative 1								
1-13	(no fossils expected)							
1-19								X
Alternative 2								
1-19								X
S-1, S-2, S-4, S-5, S-6, S-7	X	X	X					X
E-2				X				
E-3		X			X	X		
E-4		X					X	
B-1, S-3, S-8, 1-13	(no fossils expected)							
Alternative 3								
E-1, S-1, S-2	X	X	X					X
E-4		X					X	
1-19								X
Alternative 4								
1-19								X
E-1, E-5, E-6, S-1, S-2, S-4, S-5	X	X	X					X
E-2			X					
E-3		X			X	X		
E-4		X					X	
1-13, B-1, S-3, S-8	(no fossils expected)							

[1]BLM & USFS, 1989.

CULTURAL RESOURCES

Alternative 1

The potential for impacts to cultural resources would be low, even though the linear character of the pipeline construction would increase the likelihood of encountering resources. Ground disturbing activities would consist of constructing 5.2 miles of pipeline, 4.1. miles of which would not be adjacent to the well access road. Using the criteria of a 50 foot right-of-way, the 4.1 miles of projected new disturbance would impact 25 acres. Powerlines would be constructed adjacent to access roads and would result in no additional disturbance.

Alternative 2

All of the construction activities projected would have the potential to impact cultural resources. Nine step-out wells and six exploration wells would be drilled; impacting 75 acres. There would be 12.85 miles of new roads and 7.6 miles of new pipeline constructed that would not be adjacent to the access roads. Using the criteria of a 50 foot right-of-way, this 20.45 miles of new construction would impact 124 acres. Powerlines would be built adjacent to the access roads and would result in no additional disturbance. If this alternative were implemented, approximately 199 acres would be disturbed.

The potential for cultural resources within these 199 acres is unknown because there have been few cultural resource inventories in the area. The fact that the 199 acres are scattered throughout the entire EIS area increases the probability of encountering resources.

A loss of cultural values may result from the increased number of people in the EIS area. This increase would be from two sources. The first would be from personnel brought to the area by gas field development. The second source, road improvement would create greater public access to the area. This increased access could result in increased looting/collection of archaeological sites and damage to others resulting from unauthorized off-road traffic. Impacts from enhanced public access are difficult to control, but would be minor.

Alternative 3

Under this alternative, one injection well, two step out wells and two exploration wells would be drilled; impacting 25 acres. There would be 1.35 miles of new road construction and 11.4 miles of new pipeline construction that would not be adjacent to the access roads. This 12.75 miles of new construction would impact 77 acres. Powerlines would be built adjacent to access roads and would result in no additional disturbance. If this alternative were implemented, approximately 102 acres would be disturbed.

The potential for cultural resources within these 102 acres is unknown because there have been few cultural resource inventories in the area. The fact that these 102 acres are scattered throughout the entire EIS area increases the probability of encountering resources.

Cultural resources could be lost or damaged as discussed in Alternative 2, but the impacts would be minor.

Alternative 4

Under this alternative, one injection well, seven step-out wells and six exploration wells would be drilled; impacting 70 acres. There would be 12.25 miles of new road and 23.9 miles of new pipeline constructed that would not be adjacent to the access roads. This 36.15 miles of new construction would impact 219 acres. Powerlines would be built adjacent to the access roads and would result in no additional disturbance. If this alternative were implemented, approximately 289 acres would be disturbed.

The potential for cultural resources within these 289 acres is unknown because there have been few cultural resource inventories in the area. The fact that these 289 acres are scattered throughout the entire EIS area increases the probability of encountering resources.

Again, cultural resources could be lost or damaged as discussed in Alternative 2, but the impacts would be minor.

SOILS

Since oil and gas development requires varying amounts of surface disturbance, some degree of soil erosion and compaction is generally unavoidable. Increased surface disturbance (road construction, pad construction, facility construction and pipeline trenching) in areas lacking vegetation or with steep slopes, long slopes, erodible soil types, high winds and heavy rainfalls increases the potential for soil erosion and compaction.

Stockpiling topsoil is a common construction practice with this type of development and while it preserves most soil features, prolonged stockpiling generally decreases soil fertility and vegetation viability.

These general types of soil impacts were considered in all of the following alternative discussions.

Alternative 1

This alternative would impact approximately 34 acres as shown in Table 4.2.

Approximately 74 percent (25 acres) of the projected development would occur on soil types with low soil stability risk hazards (204 and 13A). The remaining 26 percent (9 acres) would occur on soil types with moderate soil stability risk hazards (14D, 161 and 200). Appendix I further defines these soil types.

Most of the expected impacts would be of the general type discussed at the beginning of this section.

About 4 acres of the assumed development would occur in land type 14D, which is characterized by rotational slump and mudflow landforms on shale parent material. A specific impact of the proposed development on this land type is the moderate cutbank slump hazard. This means that roads constructed in this soil type could result in unstable road cut and/or fill slopes. A cutbank failure could impact sediment yield if it occurred near a stream. There is presently no reliable method for estimating the quantity or frequency of this type of failure, or the proportion of soil material that could be delivered to a nearby stream.

Alternative 1 would create the fewest impacts of any of the alternatives to the soils resource.

Alternative 2

This alternative would impact approximately 181 acres as shown in Table 4.3.

About 34 percent (61 acres) of the projected development would occur in soil types with low risk hazards. However, the general impact concerns discussed at the beginning of this section would still apply to these acres.

TABLE 4.2

SOIL IMPACTS[1]
ALTERNATIVE 1

Soil Type	Road Construction Acres	Pipeline Construction Acres	Well and Plant Sweetening Construction Acres	Total Construction Acres	Percent %
Low Impact					
13A	0	4.19	0	4.19	12
204	2.89	12.99	5.00	20.88	62
			SUBTOTAL	25.07	74
Moderate Impact					
14D	0	3.59	0	3.59	11
161	0	1.62	0	1.62	5
200	0.57	2.95	0	3.52	10
			SUBTOTAL	8.73	26
TOTALS	3.46	25.34	5.00	33.80	100

[1]BLM/USFS, 1989.

About 66 percent (120 acres) of the assumed development activities would occur in soil types with moderate risk hazards (see Table 4.3). These soil types, especially 14D (61 acres) and 205 (8 acres) would be subject to the same cutbank failure risks described in Alternative 1.

Limitations to road construction because of shallow, nonrippable hard rock could occur on 12 acres (soil types 18 and 183). This limitation is most severe on soil type 183, but only 1 acre of this soil type would be projected for development.

Alternative 2 would create the most impacts of any of the alternatives to the soils resource.

Alternative 3

This alternative would impact approximately 57 acres (see Table 4.4).

About 53 percent (30 acres) of the total projected development activities would occur in soil types with low risk hazards. However, the general impact concerns discussed at the beginning of this section would still apply to these acres.

The remaining 47 percent (27 acres) of the development activities would occur in soil types with moderate risk hazards (see Table 4.4). These soil types, especially 14D (4 acres) and 205 (14 acres) would be subject to the same cutbank failure risks discussed in Alternative 1.

Alternative 4

This alternative would impact approximately 183 acres (see Table 4.5).

About 33 percent (60 acres) of the projected development activities would occur in soil types with low risk hazards. Again, the general impact concerns discussed at the beginning of this section would apply to these acres.

The remaining 67 percent (122 acres) of the projected development activities would occur in soil types with moderate risk hazards (see Table 4.5). These soils types, especially 14D (40 acres) and 205 (16 acres) would be subject to the same cutbank failure risks discussed in Alternative 1.

TABLE 4.3

SOIL IMPACTS[1]
ALTERNATIVE 2

Soil Type	Road Construction Acres	Pipeline Construction Acres	Well Construction Acres	Total Construction Acres	Percent %
Low Impact					
13A	7.6	4.19	0	11.79	6
71	3.8	0	0	3.8	2
161A	1.3	0	0	1.3	1
161B	2.5	0.61	0	3.11	2
204	7.6	16.65	15.0	39.25	22
207	1.7	0	0	1.7	1
			SUBTOTAL	60.95	34
Moderate Impact					
14D	23.9	6.77	30.0	60.67	33
18	6.3	0	5.0	11.3	6
161	13.5	2.68	5.0	21.18	12
200	4.2	3.71	10.0	17.91	10
201	0.1	0	0	0.1	0
205	0.3	3.03	5.0	8.33	5
			SUBTOTAL	119.49	66
High Impact					
183	0.9	0	0	0.9	0
TOTALS	73.7	37.64	70.0	181.34	100

[1]BLM/USFS, 1989.

TABLE 4.4

SOIL IMPACTS[1]
ALTERNATIVE 3

Soil Type	Road Construction Acres	Pipeline Construction Acres	Well and Plant Processing Construction Acres	Total Construction Acres	Percent %
Moderate Impact					
14D	0.07	3.47	0.52	4.06	7
161	0	2.21	0	2.21	4
200	0.45	2.11	3.46	6.02	11
201	0	0	0.09	0.09	0
205	2.78	1.88	9.43	14.09	25
			SUBTOTAL	26.47	47
Low Impact					
13A	0	2.75	0	2.75	5
161A	0.88	0	0	0.88	1
161B	0.58	0.33	0	0.91	2
204	1.29	12.91	11.50	25.70	45
			SUBTOTAL	30.24	53
TOTALS	6.05	25.66	25.00	56.71	100

[1]BLM/USFS, 1989.

TABLE 4.5

SOIL IMPACTS[1]
ALTERNATIVE 4

Soil Type	Road Construction Acres	Pipeline Construction Acres	Well and Sweetening Plant Construction Acres	Total Construction Acres	Percent %
Low Impact					
13A	0.72	7.34	0	8.06	4
71	1.04	0	0	1.04	1
161A	0.87	0	0	0.87	0
161B	3.44	0.87	0	4.31	2
204	1.51	37.74	5.87	45.11	25
207	1.08	0	0	1.08	1
			SUBTOTAL	60.47	33
Moderate Impact					
14D	8.36	13.59	17.91	39.86	22
18	3.17	0	8.96	12.13	7
161	13.49	7.62	9.14	30.25	16
183	0	0	0.32	0.32	0
200	0.36	12.35	11.43	24.12	13
201	0	0	0.09	0.09	0
205	1.21	4.99	9.43	15.63	9
			SUBTOTAL	122.40	67
TOTALS	35.25	84.50	63.14	182.87	100

[1]BLM/USFS, 1989.

VEGETATION

All surface disturbing activities have the potential to impact vegetation resources. Gas exploration and development usually create varying amounts of surface disturbance, depending on the size of the project and the length of time involved.

When surface disturbance reduces the amount of vegetative cover, the result can be increased sedimentation in streams and riparian areas, channel degradation and increased soil erosion.

Road, pipeline, well pad and processing plant construction activities all disturb a certain amount of vegetation and are considered in the following alternative discussions.

Oil and gas related activities could also slightly increase the potential for forest or range fires and chemical spills, which can reduce vegetative cover. Increased surface disturbance and vehicle activity could also contribute to the spread of noxious plants.

Alternative 1

This alternative would impact approximately 34 acres as shown in Table 4.6.

About 71 percent (24 acres) of the disturbance would occur in forest areas, including 7 acres of dense coniferous forest, 15 acres of open coniferous forest, and 2 acres of aspen-cottonwood forest.

Approximately 28 percent (9 acres) of the projected construction activities would occur in grassland vegetation. This would reduce the forage potential of the area by about 4,500 pounds of total forage production per year (using an estimated average annual forage production rate for grassland of 500 pounds per acre). Grazing potential would be reduced by 2.4 animal unit months (AUMs).

The entire 34 acres disturbed would be susceptible to noxious weed infestation, increasing the risk of weeds spreading onto adjacent weed-free areas. Because of the linear configuration of the area impacted by road and pipeline construction, the risk of weed invasion to adjacent areas would be greater than the acres might indicate. Continuing vehicle and equipment traffic on the roads and active wellsites could introduce weed seed to the area at any time, thus maintaining the risk of weed invasion throughout the life of the project.

This alternative would not impact any known habitat of plant species of special concern. The risk of the proposed development impacting yet undiscovered rare or sensitive plant habitat would be low.

This alternative would disturb the fewest surface acres and vegetation of the four considered.

TABLE 4.6

VEGETATION IMPACTS[1]
ALTERNATIVE 1

Vegetation Type	Road Construction Acres	Pipeline Construction Acres	Well and Sweetening Plant Construction Acres	Total Construction Acres
Closed Conifer 40-100% CC	0	7.20	0	7.20
Open Conifer 10-40% CC	1.86	12.38	0.49	14.73
Cottonwood/Aspen 10% CC	0.12	2.24	0	2.36
Grassland less than 10% CC	1.48	3.39	4.53	9.40
Gravel Bar	0	0.13	0	0.13
Total Acres	3.46	25.34	5.02	33.82

[1]BLM/USFS, 1989.

Alternative 2

This alternative would disturb approximately 182 acres as shown on Table 4.7.

About 77 percent (140 acres) of the disturbance would occur in forest areas, including 89 acres of dense coniferous forest, 28 acres of open coniferous forest, and 23 acres of aspen-cottonwood forest.

Approximately 20 percent (36 acres) of the construction activities would occur in grassland vegetation. This would reduce forage potential by about 18,000 pounds per year. Grazing potential would be reduced by about 14.8 AUMs.

The entire 182 acres disturbed would be susceptible to noxious weed infestation, increasing the risk of weed spread onto adjacent weed-free areas as discussed in Alternative 1.

The risk of impacts to sensitive plants or plant species of special concern would be the same as discussed in Alternative 1. The potential for impacts would be greater with this alternative because of the number of activities.

Alternative 3

This alternative would disturb approximately 57 acres as shown in Table 4.8.

About 66 percent (38 acres) of the projected disturbance would occur on forest areas, including 25 acres of dense coniferous forest, 10 acres of open coniferous forest, and 3 acres of aspen-cottonwood forest.

Thirty-three percent (19 acres) of the construction activities would occur in grassland vegetation; reducing forage potential by about 9,500 pounds per year. Grazing potential would be reduced by about 3.4 AUMs.

The entire 57 acres disturbed would be susceptible to noxious weed infestation as described in Alternative 1.

The risks and potential impacts to plant species of special concern would be the same as discussed in Alternatives 1 and 2.

Compared to the other alternatives, Alternative 3 would create intermediate impacts to vegetation resources.

Alternative 4

This alternative would impact approximately 184 acres (see Table 4.9).

About 81 percent (149 acres) of the projected disturbance would occur on forest areas, including 86 acres of dense coniferous forest, 47 acres of open coniferous forest, and 16 acres of aspen-cottonwood forest.

Approximately 16 percent (29 acres) of the construction activities would occur in grassland vegetation and 6 acres of gravel bar area. This would reduce forage potential of the area by about 14,500 pounds per year. Grazing potential would be reduced by about 11.9 AUMs.

The entire 184 acres disturbed would be susceptible to noxious weed infestation as discussed in Alternative 1.

The projected development would not impact any known habitat of plant species of special concern. The risk of the proposed development impacting yet undiscovered rare plant habitat is low.

Compared to the other alternatives, Alternative 4 has the highest acreage of disturbance and related vegetation impacts.

TABLE 4.7

VEGETATION IMPACTS[1]
ALTERNATIVE 2

Vegetation Type	Road Construction Acres	Pipeline Construction Acres	Well Construction Acres	Total Construction Acres
Closed Conifer 40-100% CC	44.70	14.25	30.0	88.95
Open Conifer 10-40% CC	9.8	15.98	2.5	28.28
Cottonwood/Aspen 10% CC	2.7	2.84	17.5	23.04
Grassland less than 10% CC	14.5	4.44	17.5	36.44
Gravel Bar	2.2	0.13	2.5	4.83
Total Acres	73.9	37.64	70.0	181.54

[1]BLM/USFS, 1989.

TABLE 4.8

VEGETATION IMPACTS[1] ALTERNATIVE 3

Vegetation Type	Road Construction Acres	Pipeline Construction Acres	Well and Sweetening Plant Construction Acres	Total Construction Acres
Closed Conifer 40-100% CC	1.09	14.13	9.84	25.06
Open Conifer 10-40% CC	2.61	6.91	0.67	10.19
Cottonwood/Aspen 10% CC	0.05	2.31	0	2.36
Grassland less than 10% CC	2.30	2.22	14.55	19.07
Gravel Bar	0	0.09	0	0.09
Total Acres	6.05	25.66	25.06	56.77

[1]BLM/USFS, 1989.

TABLE 4.9

VEGETATION IMPACTS[1] ALTERNATIVE 4

Vegetation Type	Road Construction Acres	Pipeline Construction Acres	Well and Sweetening Plant Construction Acres	Total Construction Acres
Closed Conifer 40-100% CC	17.62	40.77	27.27	85.66
Open Conifer 10-40% CC	4.23	33.69	9.49	47.41
Cottonwood/Aspen 10% CC	2.82	4.53	8.27	15.62
Grassland less than 10% CC	10.58	3.87	14.53	28.98
Gravel Bar	0	1.89	4.33	6.22
Total Acres	35.25	84.75	63.89	183.89

[1]BLM/USFS, 1989.

LIVESTOCK

Impacts to livestock can be classified as direct or indirect. Direct impacts are those associated with vehicles and equipment, or monitoring from roadways where livestock are disturbed, moved, injured, etc. Another direct impact could result from gates being left open and having livestock mix or to wander away from authorized pastures.

Indirect impacts to livestock refer to impacts on forage, water, or the management facilities that livestock depend upon when using the public land. Any action that reduces vegetative cover will also impact the amount of forage or shelter available to livestock. Usually, the greater the amount of vegetation removed, the more animal-unit-months (AUMs) that are lost. Because nonproductive wellsites, the nonessential pad areas around producing wells and access roads are revegetated, impacts are usually temporary.

For the purposes of this EIS, 8 acres per AUM are used to calculate the forage lost, as this is an approximate state average for carrying capacity. This would represent an upper limit capacity because the productivity is probably less for the Rocky Mountain Front (10-20 acres/AUM) where much rock outcrop and noncommercial timber canopy exist.

The reader will note that not all of the projected wells are discussed in the livestock section. Wells 1-8, 1-16, 1-19, B-1, S-1, S-2, S-3 and S-4 are within the Blackleaf Wildlife Management Area (WMA). No livestock grazing is permitted within this area and these wells would not impact livestock.

Alternative 1

This alternative would impact livestock in only the Cow Creek Allotment and would result in 2.4 AUMs lost. Table 4.10 details the indirect impacts (AUMs lost) in this allotment.

Of the current available forage, 19.7 acres would be lost for the life of the field.

Alternative 2

This alternative would impact livestock in four allotments (see Table 4.11) and would result in 14.8 AUMs lost; a low impact.

Direct impacts to livestock could occur only if the projected development and exploration occurred during the 07/01-09/30 grazing period. The disturbance caused by vehicles, road building equipment and pipeline digging would cause only minor livestock movement. The increased probability of fence gates being left open could result in livestock drifting into unauthorized pastures. There is a slight risk that the increased traffic flow could cause animals to be hit by vehicles.

Indirect impacts to livestock numbers would occur through the reduction of livestock forage. It is estimated that 118.4 acres of the current available forage would be lost; those acres associated with the step-out wells are assumed to be lost for the life of the field. The acres associated with the exploration wells would be a short-term loss. Table 4.11 shows the numbers of wellsites and related activities per allotment and the associated disturbed acreages.

TABLE 4.10

IMPACTS TO LIVESTOCK[1]
(Cow Creek Allotment Only)
ALTERNATIVE 1

Development	Miles	Acres Disturbed	AUMs Lost	Indirect Impact*	Direct Impact*
Road Reconstruction	1.7	3.3	0.4	Minor	Minor
Road Maintenance	3.45	6.2	0.77	Minor	Minor
Pipeline (adjacent to access road)	0.75	1.0	0.1	Minor	Minor
Pipeline (outside access road)	2.85	4.2	0.52	Minor	Minor
Central Production Facility	1.0 Unit	5.0	0.67	Minor	Low
Total	8.75	19.7	2.4		

*Minor Impact = 10 or less AUMs lost
Low Impact = 11-20 AUMs lost
Moderate Impact = 21-50 AUMs lost
Significant Impact = more than 50 AUMs lost

[1]BLM, 1989.

TABLE 4.11

IMPACTS TO LIVESTOCK[1]
ALTERNATIVE 2

Facility	Scoffin Creek[2]	Dupuyer Creek[3]	Cow Creek[4]	Chicken Coulee[5]
Exploration well	E-4	E-5, E-6	0	E-1, E-2 E-3
Acres Disturbed	5	10	0	15
AUMs Lost	0.6	1.2	0	1.8
Production Well	0	0	1-5, 1-13	0
Acres Disturbed	0	0	10	0
AUMs Lost	0	0	1.2	0
Step-out Well	0	0	S-5, S-6, S-7, S-8	0
Acres Disturbed	0	0	20	0
AUMs Lost	0	0	2.5	0
Maintenance and Reconstructed Roads (miles)	1	4.9	6.2	5.2
Acres Disturbed	1.9	9.5	9	10.1
AUMs Lost	0.3	1.2	1.1	1.3
New Road (miles)	0	0.25	6.2	5
Acres Disturbed	0	0.5	11.3	10.7
AUMs Lost	0	0	1.4	1.3
Pipeline (adjacent to access road)	0	0	6.9	0
Acres Disturbed	0	0	0	0
AUMs Lost	0	0	0	0
Pipeline (outside access road)	0	0	3.9	0
Acres Disturbed	0	0	5.7	0
AUMS Lost	0	0	.7	0
Total Acres Impacted	6.9	20	56	35.8
Total AUMs Lost	0.9	2.4	6.9	4.4

[1]BLM, 1989.

[2]Scoffin Creek	109 Cattle	07/01-08/31	USFS
[3]Dupuyer Creek	86 Cattle	07/01-09/10	USFS
[4]Cow Creek	102 Cattle	07/01-09/05	USFS
[5]Chicken Coulee	233 Cattle	07/01-09/30	USFS/BLM/private

Alternative 3

This alternative would impact three allotments and result in 3.4 AUM lost (see Table 4.12); a minor impact. Direct impacts to livestock would be essentially the same as described under Alternative 2. There would be 17.75 miles of assumed pipelines which would increase potential livestock impacts slightly. Table 4.12 shows the numbers of projects per allotment and the approximate AUMs lost.

It is estimated that 29 acres of the current available or potential forage would be lost as explained in Alternative 2. The total impact to livestock production would be minor.

Alternative 4

This alternative would impact four allotments and result in 11.9 AUMs lost; a low impact. It is estimated that 96.5 acres of the currently available or potential forage would be lost as explained in Alternative 2. Table 4.13 summarizes these impacts.

TABLE 4.12

IMPACTS TO LIVESTOCK[1] ALTERNATIVE 3

Facility	Scoffin Creek	Cow Creek	Chicken Coulee
Exploration well	E-4	0	E-1
Acres Disturbed	5	0	5
AUMs Lost	0.6	0	0.6
Production Well	0	1-5, 1-13	0
Acres Disturbed	0	10	0
AUMs Lost	0	1.2	0
Step-out Well	0	0	0
Acres Disturbed	0	0	0
AUMs Lost	0	0	0
Maintenance and Reconstructed Roads (miles)	1	1.25	2
Acres Disturbed	1.9	2.3	3.9
AUMs Lost	0.2	0.3	0.5
New Road (miles)	0	0	0
Acres Disturbed	0	0	0
AUMs Lost	0	0	0
Pipeline (adjacent to access road)	0	0.25	0
Acres Disturbed	0	0	0
AUMs Lost	0	0	0
Pipeline (outside access road)	0	0.25	0
Acres Disturbed	0	0.4	0
AUMs Lost	0	0	0
Total Acres Impacted	6.9	12.7	8.9
Total AUMs Lost	0.8	1.5	1.1

[1]BLM, 1989.

TABLE 4.13

IMPACTS TO LIVESTOCK[1]
ALTERNATIVE 4

Facility	Scoffin Creek	Dupuyer Creek	Cow Creek	Chicken Coulee
Exploration well	E-4	E-5, E-6	0	E-1, E-2 E-3
Acres Disturbed	5	10	0	15
AUMs Lost	0.6	1.2	0	1.8
Production Well	0	0	1-5, 1-13	0
Acres Disturbed	0	0	10	0
AUMs Lost	0	0	1.2	0
Step-out Well	0	0	S-5, S-8	0
Acres Disturbed	0	0	10	0
AUMs Lost	0	0	1.2	0
Maintenance and Reconstructed Roads (miles)	1	4.9	5.3	5.2
Acres Disturbed	1.9	9.5	7.7	10.1
AUMs Lost	0.2	1.2	1	1.2
New Road (miles)	0	0.25	3.1	5.5
Acres Disturbed	0	0.5	5.6	10.7
AUMs Lost	0	0.1	0.7	1.2
Pipeline (adjacent to access road)	0	6.7	5.2	0
Acres Disturbed	0	0	0	0
AUMs Lost	0	0	0	0
Pipeline (outside access roads)	0	0	4.2	0
Acres Disturbed	0	0	6.1	0
AUMS Lost	0	0	0.8	0
Total Acres Impacted	6.9	20	33.8	35.8
Total AUMs Lost	0.8	2.5	4.9	4.2

[1]BLM, 1989.

WILDLIFE

One of the important relationships analyzed in this EIS is the relationship between wildlife and mineral development. The following information (Bromley 1985) will aid BLM's analysis and possibly the reader's understanding of the impacts to wildlife from oil and gas development.

1. "The severity of the effect is site-specific and depends on such factors as (a) the sensitivity of the species affected, (b) the nature of the disruption, (c) the characteristics and importance of the affected habitat, and (d) the availability and condition of alternative habitat."

2. "Response to disruptions varies among species and/or individuals and is dependent on numerous factors including: (a) the previous experience of the animal with a given disruption, (b) characteristics of the disruption, (c) characteristics of the habitat, (d) characteristics of the animal and/or group, and (e) timing of the disruption in relation to critical periods of the animal's life cycle."

3. "The effects of petroleum development may be most critical in certain highly sensitive situations including: (a) during times when animals are already stressed by natural conditions, (b) in habitats traditionally used by populations during critical periods of their life cycle, (c) for species whose social organization and/or behavior makes them particularly susceptible to disturbance, and (d) for certain sex/age groups of animals."

4. "An understanding of the general concepts of animal behavior and energetics is necessary to fully comprehend the consequences of petroleum development activities on wildlife."

Negative effects result when the oil and gas activity creates a disruption that causes a change in the energy and nutrient budgets of the individual animal affected. Negative effects occur in or within an influence zone of the animal's home, and are most severe when home space (habitat) is limited and/or the animal is already stressed at critical times in its life cycle.

The effect of raising the energy cost of living is at the expense of energy needed for reproduction, growth and survival (Geist 1970), and sometimes can be measured with these factors. Raises in the cost of living from disruption occur from the physiological excitement preparing the animal for exertion, the cost of locomotion incurred when an animal attempts to escape a disruption, the loss of food intake because of this stress, and the cost of suboptimal habitat selection (Bromley 1985). Tables 4.14, 4.15 and 4.16 summarize the potential environmental disruptions resulting from oil field activities and the primary and secondary impacts which may occur from these disruptions.

TABLE 4.14

POTENTIAL ENVIRONMENTAL DISRUPTIONS RESULTING FROM OIL FIELD ACTIVITIES[1]

	Potential environmental disruption						
Activity	Noise	Aircraft	Human intrusion	Traffic and access	Structures and facilities	Alteration of vegetation/ land	Harmful substances
Ground surveys			X	X			
Seismic trail clearing	X		X	X		X	
Seismic wave production/ recording	X		X				
Clearing/grading right-of-way	X		X	X		X	
Road construction	X		X	X	X	X	
Mobilization of trucks/ equipment	X		X				X
Site development (clearing/ grading)	X		X			X	
Drill pad construction	X		X			X	
Excavation of storage/ mud pits	X		X		X	X	X
Drilling and related activities	X		X				
Water supply	X		X	X	X		

TABLE 4.14 (continued)

POTENTIAL ENVIRONMENTAL DISRUPTIONS RESULTING FROM OIL FIELD ACTIVITIES[1]

Activity	Potential environmental disruption						
	Noise	Aircraft	Human intrusion	Traffic and access	Structures and facilities	Alteration of vegetation/ land	Harmful substances
Borrow pit excavation	X		X			X	
Wellhead/pump unit installation	X				X		
Construction of process/ treatment/storage facilities	X		X		X	X	
Installation of flow lines	X				X	X	
Erection of power lines	X				X	X	
Communication system development	X				X	X	
Operation of process/ treatment facilities	X		X				
Pipe stringing	X		X		X		
Trenching and pipe installation	X		X			X	
Pipe burial and backfill	X		X		X	X	
Maintenance and inspection			X				
Accidents						X	X
Secondary recovery	X		X				
Air support	X	X					
Worker accommodations			X				
Increase in local population			X	X			
Development of ancillary industry			X			X	
Well plugging	X		X				
Site restoration/revegetation	X		X				

[1]Bromley, M., 1985, Wildlife Management Implications of Petroleum Exploration and Development in Wildland Environments, USFS publication, General Technical Report INT-191.

TABLE 4.15

PRIMARY IMPACTS POTENTIALLY RESULTING FROM ENVIRONMENTAL DISRUPTIONS[1]

	Environmental Disruption						
Primary impact	Noise	Aircraft	Human intrustion	Traffic and access	Structures and facilities	Alteration of vegetation/ land	Harmful substances
Interruption of activity/ alarm/flight	X	X	X	X			
Avoidance/displacement	X	X	X	X	X		
Permanent loss of habitat use			X	X		X	X
Decreased reproductive success		X	X				
Interference with movement	X	X	X	X	X		
Direct mortality			X	X	X		X
Interference with courtship	X		X				
Alteration of behavior			X				
Change in community structure						X	

[1]Bromley, M., 1985.

TABLE 4.16

SECONDARY IMPACTS WHICH MAY OCCUR AS CONSEQUENCES OF PRIMARY IMPACTS[1]

	Primary impacts									
Secondary impact	Interruption of activity/ alarm/ flight	Avoidance/ displacement	Permanent loss of habitat	Decreased reproductive success	Interference with movement	Direct mortality	Nest/den abandonment	Interference with courtship	Change in community structure	Alteration of behavior
Decreased use/temporary desertion of traditional areas		X								
Shift in range		X								
Change in distribution		X								
Overutilization/overpopulation of adjacent habitat		X	X							

TABLE 4.16 (continued)

SECONDARY IMPACTS WHICH MAY OCCUR AS CONSEQUENCES OF PRIMARY IMPACTS[1]

Secondary impact	Primary impacts									
	Interruption of activity/alarm/flight	Avoidance/displacement	Permanent loss of habitat	Decreased reproductive success	Interference with movement	Direct mortality	Nest/den abandonment	Interference with courtship	Change in community structure	Alteration of behavior
Use of marginal habitat		X								
Gradual range abandonment		X			X					
Inefficient use of habitat	X	X			X					
Mortality		X	X					X		
Reduced feeding efficiency	X	X								
Change in activity patterns	X	X								
Interference with/alteration of movements		X								
Decreased availability/elimination of food source			X			X				
Inadequate nutrition					X					
Insufficient energy reserves for migration					X					
Reduction in numbers			X							
Adverse physiological effects			X		X					
Disruption of social structure/group composition		X			X					
Reduced reproductive potential/success	X		X		X					

TABLE 4.16 (continued)

SECONDARY IMPACTS WHICH MAY OCCUR AS CONSEQUENCES OF PRIMARY IMPACTS[1]

Secondary impact	Primary impacts									
	Interruption of activity/alarm/flight	Avoidance/displacement	Permanent loss of habitat	Decreased reproductive success	Interference with movement	Direct mortality	Nest/den abandonment	Interference with courtship	Change in community structure	Alteration of behavior
Nest desertion		X								
Decrease in nest/density sites			X							
Delay/failure to den					X					
Den displacement		X								
Decreased survival/loss of young			X		X					
Increased use of alternate nests		X								
Decrease in aquatic productivity			X							
Human injury/property damage										X
Delay/failure to reach traditional range					X					
Ease of travel					X					
Increased vulnerability to predators					X					
Interference with mating synchrony					X					

[1]Bromley, M., 1985.

Alternative 1

The locations of oil and gas activities projected in this alternative are shown on Figure 2.2 in Chapter 2 and the locations of important wildlife habitats are illustrated in Chapter 3. Combining this information resulted in Table 4.17, which illustrates those wildlife habitats with the greatest potential for impacts.

Table 4.17 and similar tables for the remaining alternatives, were developed using a 1-mile buffer (zone of influence). Buffer zones differ by species and reference source (Rocky Mountain Front Wildlife Guidelines) but generally range from greater than 1/2-mile to 3 miles. The most common buffer is 1 mile and that is the standard distance used for analysis in this document. Figure 4.1 illustrates the sometimes overlapping buffer zones in this alternative. The effectiveness of buffers is dependent on many factors other than distance, including topography and vegetative screening. The Cumulative Effects Model (USFS 1987) utilizes different zones of influence depending on the severity and type of activity as well as topography (see Appendix G).

If construction activities were scheduled in the fall, short-term disturbance of year-round occupants residing within the zones of influence could occur. Year-round occupants include the grizzly bear, predators, furbearers and Rocky Mountain goat. Some of the early deer and elk migrants could also be affected.

Because the EIS area serves as critically important deer and elk winter range, construction activities during the winter and spring would cause the most significant negative consequences. These species are also attractants to predators, possibly including the endangered gray wolf. During the spring, the areas close to wellheads and along portions of the pipeline routes are close to Rocky Mountain goat breeding, kidding, and nursery habitat. Carrion on the big-game winter range attracts grizzly bears in the spring, and since this area is where greenup first occurs, the bears arrive immediately after den emergence. The riparian vegetation associated with Antelope Butte Swamp is also important to the grizzly during the summer and fall periods, but it is especially critical to them during the spring. Also, projected disturbance areas lie near important raptor breeding habitats which may be occupied from February to the end of July.

Piping the excess water a mile and re-injecting it would cause short-term impacts, unless the pipeline should break and spill which would also be highly unlikely. Maintenance checks, possibly weekly, at the re-injection wellsite would be a long-term disturbance associated with this project.

The keys to lessening and possibly avoiding impacts to wildlife from the activities proposed in this alternative are: to time the activities so that they do not take place when wildlife are present, or at least not during critical times in their life cycle; and to using remote monitoring of oil and gas activities. Therefore, the short-term impacts of such things as pipeline construction, could usually be timed to avoid impacting the most important species. Activities which must occur year-round such as trucking condensate and daily manning of a central production facility, would be minor long-term disturbances.

TABLE 4.17

IMPORTANT HABITAT LYING WITHIN THE ZONE OF INFLUENCE (1-MILE) OF ALL ACTIVITIES PROPOSED IN ALTERNATIVE 1[1]

		Producers		Easternmost Structure		Shut-in Wells	
Species	Habitats	1-8	1-5	Gas Plant	Injection Well	1-13	1-19
GRIZZLY BEAR	Spring Habitat	X	X	X	X	X	X
	Yearlong Habitat (includes spring, summer and fall)					X	X
	Alpine Feeding Areas and Subalpine Fir/Whitebark Pine Site					X	X
	Denning Habitat						

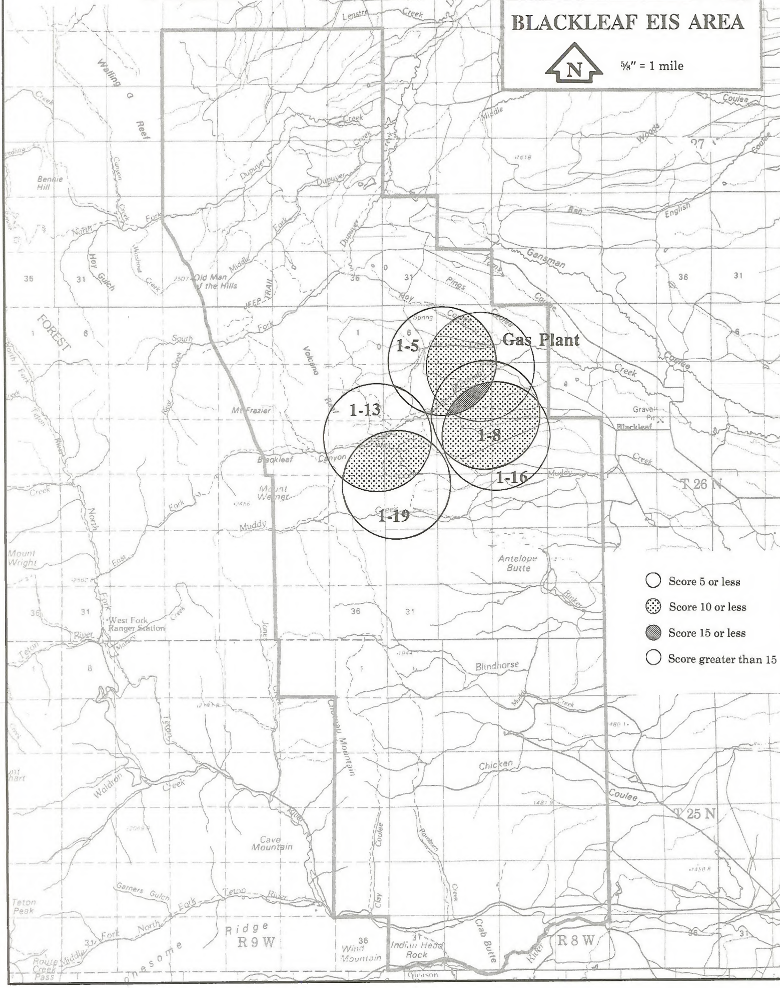
TABLE 4.17 (continued)
IMPORTANT HABITAT LYING WITHIN THE ZONE OF INFLUENCE (1-MILE) OF ALL ACTIVITIES PROPOSED IN ALTERNATIVE 1[1]

		Producers		Easternmost Structure		Shut-in Wells	
Species	Habitats	1-8	1-5	Gas Plant	Injection Well	1-13	1-19
ROCKY MOUNTAIN GOAT	Occupied Yearlong Habitat					X	X
	Mineral Lick						
	Kidding/Nursery Areas					X	X
	Breeding/Kidding/Nursery						
	Suitable Low Occupancy Habitats						
	Transitional Habitats					X	X
BIGHORN SHEEP	Winter Range Lambing Area					X	
ELK	Winter Range	X	X	X	X	X	X
	Calving Area					X	X
	Migration Routes					X	X
MULE DEER	Winter Range	X	X	X	X	X	X
	Fall Transitional Range					X	
	Migration Route						
RAPTORS	Golden Eagle					X	X
	Prairie Falcon					X	X
	Merlin					X	X
	Acipiter Nesting						
	Habitat (both occupied and potential)						
	Riparian Habitat for raptors	X	X	X	X	X	X
	Peregrine Falcon Potential Nesting Areas					X	X
	Bald Eagle Winter Concentration Area						
GROUSE	Sharptailed Grouse "LEK"	All three leks lie just on the eastern edge of the EIS area.					
FISH	Fisheries (if within drainage)		X			X	

X indicates that the habitat lies within the zone of influence (1 mile) of the well site or associated road or pipeline.

[1]BLM, 1989.

Figure 4.1 Cumulative Effects on Wildlife in Alternative One on a One-Mile Zone of Influence.



Cumulative Effects on Wildlife for Alternative 1 Based on a One-Mile Zone of Influence as Shown on Figure 4.1.

	1-8	1-5	Gas Plant	1-16	1-13	1-19
Grizzly Bear (Spring range or denning habitat)	X	X	X	X	X	X
Rocky Mountain Goat (Occupied habitat or lick)					X	X
Bighorn Sheep (Winter range)						
Elk (Winter range)	X	X	X	X	X	X
Mule Deer (Winter range)	X	X	X	X	X	X
Raptors (Prairie Falcon or Golden Eagle occupied cliffs)					X	X
Score	3	3	3	3	5	5

— Habitat delineations from the Interagency Rocky Mountain Front Wildlife Monitoring/Evaluation Program, BLM et al., 1987.

— Each site receives a score of one when a species habitat lies within one mile of the well location.

— Scores are cumulative when effects from two or more sites overlap.

Alternative 2

This alternative projects the greatest number of step-out and exploration wells with facilities at each producing wellsite. This would require daily to weekly visitation, with an extensive road system. and would affect the highest number of important wildlife habitats (see Table 4.18).

The greatest amount of conflict would occur in a northwest to southeast line through the center of the EIS area (the face of the Rocky Mountain Front). This is where the greatest number of important wildlife habitats overlap. This area is also of interest to industry and is where most of the projected drilling would occur.

West of this line, impacts would be significant because of the difficulty of developing access into projected sites however, fewer species would be affected. East of this line, off the toe of the slope, extremely important habitat exists (spring grizzly bear, deer and elk winter range), but access is much simpler as a road network already exists.

The degree of negative impact to wildlife would be directly proportionate to where the well is located in relation to important wildlife habitats (see Table 4.18) and how easily the drilling activity would fit into a timing window (see Figure 2.5 in Chapter 2).

Typical late summer, fall, and early winter drilling windows in the mid-July to mid-December period (and lengthened if necessary on one end or the other depending on locality) could be used to lessen drilling impacts. However, significant negative impacts would still occur, especially along the face of the Front and west of the face where so many important species' habitats overlap (see Table 4.18 and Figure 4.2).

This area lies parallel with the project's westernmost oil and gas structure. Of the 16 projected step-out or exploratory wells along this structure, all but four (E-3, E-4, E-6 and S-2) lie within a 1-mile zone of influence of virtually all important habitat categories found on the Front. The closer a wellsite is to the face, the greater the likelihood it would impact more habitats. Step-out wells S-3 through S-8 appear to be sited in areas of the highest wildlife values. Access difficulties to the sites further west (E-2, E-3, and E-5) would make it difficult to adhere to timing windows.

Wellsites located over a mile east of the face (1-5, 1-8 and S-1), eliminate most impacts to wildlife species. Much of this country is spring grizzly bear habitat as well as elk and deer winter range. Some of it also has very high riparian vegetation values. With only one new well (S-1) projected for this area, impacts would not be significant.

Most drilling would last for 120 days or less (possibly two drilling periods in consecutive years, should access be extremely difficult). Thus, the impacts from drilling and associated activities, even though significant, would be temporary and short term.

The most significant impact to wildlife from full field development, as projected, would be the long-term impacts of development and production. These impacts could last for the life of the field, which is projected to be up to 25 years. The significance of the negative impacts during any given year would depend on how many and what kind of activities would be occurring. Timing windows cannot lessen many of the impacts to wildlife from production. Daily to weekly visits to wellheads and other weekly human intrusions may be necessary. At the far eastern boundary of the EIS area, little important habitat occurs and impacts from production facilities would be negligible.

TABLE 4.18

IMPORTANT HABITATS LYING WITHIN THE ZONE OF INFLUENCE (1-MILE) OF ALL ACTIVITIES PROPOSED IN ALTERNATIVE 2[1]

		EASTERNMOST STRUCTURE			SHUT-IN WELLS			WESTERNMOST STRUCTURE												
		Producers																		
Species	Habitats	1-8	1-5	S-1	1-13	1-19	B-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	E-1	E-2	E-3	E-4	E-5	E-6
GRIZZLY BEAR	Spring Habitat	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Yearlong Habitats (includes summer and fall)				X	X	X		X	X	X	X	X			X				
	Alpine feeding areas and subalpine fir/white-bark pine sites				X	X	X		X	X	X	X	X			X				
	Denning Habitat																		X	

TABLE 4.18 (continued)

IMPORTANT HABITATS LYING WITHIN THE ZONE OF INFLUENCE (1-MILE) OF ALL ACTIVITIES PROPOSED IN ALTERNATIVE 2[1]

		EASTERNMOST STRUCTURE Producers			SHUT-IN WELLS									WESTERNMOST STRUCTURE						
Species	Habitats	1-8	1-5	S-1	1-13	1-19	B-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	E-1	E-2	E-3	E-4	E-5	E-6
ROCKY MOUNTAIN GOAT	Occupied Yearlong Habitat				X	X	X		X	X	X	X	X	X		X			X	
	Mineral Lick											X		X		X			X	
	Kidding/ Nursery Areas Breeding/ Kidding/ Nursery				X	X	X		X	X	X	X	X	X		X			X	
	Suitable Low Occupancy Transitional Habitats				X	X	X	X	X	X	X	X	X		X		X	X	X	
BIGHORN SHEEP	Winter Range				X						X	X	X	X		X	X		X	
	Lambing Area																			
ELK	Winter Range	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
	Calving Area				X	X	X	X	X	X	X	X	X	X						
	Migration Routes				X	X	X					X								
MULE DEER	Winter Range	X	X	X	X	X	X	X	X	X	X				X	X	X	X		
	Fall Transitional Range				X				X			X	X			X	X			
	Migration Route							X								X	X			
RAPTORS	Golden Eagle				X	X	X	X	X	X	X	X	X	X	X	X	X		X	X
	Prairie Falcon				X	X	X	X	X	X	X	X	X	X		X			X	
	Merlin			X	X	X	X	X	X	X					X	X	X	X		X
	Acipiter Nesting Habitat (both occupied & potential)			X	X	X	X		X			X	X	X				X	X	X
	Riparian Habitat for Raptors	X	X	X	X	X	X	X	X	X	X	X	X		X	X		X	X	X

TABLE 4.18 (continued)

IMPORTANT HABITATS LYING WITHIN THE ZONE OF INFLUENCE (1-MILE) OF ALL ACTIVITIES PROPOSED IN ALTERNATIVE 2[1]

		EASTERNMOST STRUCTURE Producers			SHUT-IN WELLS			WESTERNMOST STRUCTURE												
Species	Habitats	1-8	1-5	S-1	1-13	1-19	B-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	E-1	E-2	E-3	E-4	E-5	E-6
	Peregrine Falcon Potential Nesting Areas				X	X	X	X	X	X	X	X	X	X						X
	Bald Eagle Winter Concentration Area																X	X		
GROUSE	Sharptailed Grouse "LEK" — All three leks lie just on the eastern edge of the EIS area, possible slight impact from use of roads.																			
FISH	Fisheries (if within drainage)		X		X						X	X	X	X				X	X	X

X — indicates that the habitat lies within the zone of influence (1 mile) of the well site or associated road or pipeline.

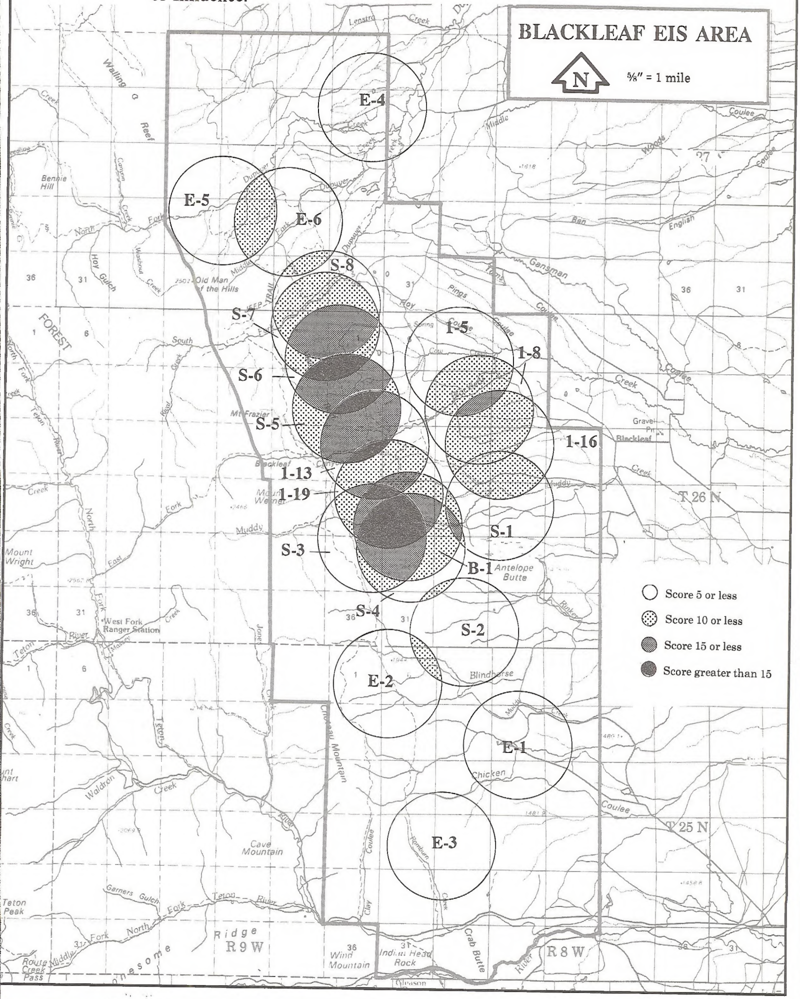
[1]BLM, 1989.

Development activities located close together such as the 1-19, B-1, S-3, S-4, 1-13 and S-5 through S-8 sites (see Figure 2.5 in Chapter 2) would create significant impacts. Such impacts could reduce wildlife populations if the mitigation measures do not prove adequate. "Mammals learn to minimize encounters with humans, if harassed enough, by reducing activity to areas, habitats, and times of day where encounters with humans are minimal" (Geist 1971). This can change the ecology or reduce the size of a population by habituating animals to live in second-rate habitats (Bromley 1985). The decline of the Rocky Mountain goat population occurring in these areas already may be the result of increased and cumulative seismic activity along the Front (Joslin, G. 1986).

The cumulative effects of the S-6, S-7, and S-8 wells on bighorn sheep habitats in the South Fork Dupuyer Creek and Volcano Reef area just might be too severe for continued sheep occupancy in this area. Susceptibility of bighorns to stress-induced disturbances has been summarized by Stemp, 1983. It could even be theorized that at the mouth of Muddy Creek the 1-19, B-1, S-3 and S-4 sites could result in lowered carrying capacity for mule deer on this portion of the Blackleaf Wildlife Management Area (Ihsle-Pac et al. 1988). Reducing the number of development activities in these areas would lessen the likelihood of these thresholds being reached and would be the best mitigation possible.

Abandonment of facilities would result in some additional human disruptions near the end of the project, but would also result in the termination of development related activity and noise. Depending on the degree of man's efforts, wildlife habitat may be restored and possibly improved. Of particular importance would be those decisions concerning disposition of access roads. They could be rehabilitated, abandoned, administratively closed if publicly owned or in cooperation with private surface owners, or left for local residents to use. However, it would be likely that the wildlife values present before field development may not be totally restored, as negative impacts would be cumulative over the life of the field.

Figure 4.2 Cumulative Effects on Wildlife in Alternative Two on a One-Mile Zone of Influence.



Cumulative Effects on Wildlife for Alternative 2 Based on a One-Mile Zone of Influence as Shown on Figure 4.2.

	1-8	1-5	S-1	1-13	1-19	B-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	E-1	E-2	E-3	E-4	E-5	E-6
Grizzly Bear (Spring range or denning habitat)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Rocky Mountain Goat (Occupied habitat or lick)				X	X	X		X	X	X	X	X	X		X			X	
Bighorn Sheep (Winter range)										X	X	X	X					X	
Elk (Winter range)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
Mule Deer (Winter range)	X	X	X	X	X	X	X	X	X	X				X	X	X	X		
Raptors (Prairie Falcon or Golden Eagle occupied cliffs)				X	X	X	X	X	X	X	X	X	X		X			X	
SCORE	3	3	3	5	5	5	4	5	5	6	5	5	5	3	5	2	3	5	2

— Habitat delineations from the Interagency Rocky Mountain Front Wildlife Monitoring/Evaluation Program, BLM et al., 1987.

— Each site receives a score of one when a species habitat lies within one mile of the well location.

— Scores are cumulative when effects from two or more sites overlap.

Alternative 3

Adherence to the Rocky Mountain Front Wildlife Guidelines and the Headwaters RMP/EIS would alleviate the most severe impacts in the EIS area, but would also substantially lower the number of wells that could be drilled.

Because of the great amount of overlapping habitats (see Figure 4.3), incompatibility with recommended timing windows and the anticipated difficulty of accessing such rugged terrain (Area A in Figure 2.7), only those activities proposed for the easternmost structure and three of the wells in the westernmost structure are considered in this alternative (Area B and C in Figure 2.7). Appendix F explains how these areas were defined.

Table 4.19 lists the important wildlife habitats that would be impacted by the projected activities in this alternative. Impacts from development activities in the easternmost structure were discussed in Alternative 2. Likewise, the kinds of impacts that would occur in the westernmost structure were discussed in Alternative 1. However, the three sites considered in this alternative (E-2, E-4 and S-2) east of the Front, can be easily accessed, (two are already along existing roads) and do not lie in such a large number of species habitats. Golden eagle and prairie falcon breeding and deer and elk winter range are the principal areas of conflict, and most negative impacts would be lessened by following a late summer to late fall drilling window.

Operating the gas processing facility, including daily manning plus periodic checks of the re-injection well, would be the most prevalent long-term impact from the production phase of this alternative. Remote monitoring of producing wells would hold human visitation to these sites to a minimum.

During the production phase of this field, the habitats most affected would be grizzly bear spring range, deer and elk winter range, and riparian areas important to raptors. These habitats are within the the gas plant and re-injection well zone of influence

TABLE 4.19

IMPORTANT HABITATS LYING WITHIN THE ZONE OF INFLUENCE (1-MILE) OF ALL SITES PROPOSED IN ALTERNATIVE 3[2]

		EASTERNMOST STRUCTURE							WESTERNMOST STRUCTURE			
		Producers					Shut-in Wells		Step Out & Exploration			Total
Species	Habitats	1-8	1-5	S-1	Gas Plant	Injection Well	1-13	1-19	S-2	E-1	E-4	Acres Affected
GRIZZLY BEAR	Spring Habitat	2,010[1]	2,010	2,010	2,010	2,010	2,010	2,010	2,010	2,010	2,010	20,100
ROCKY MOUNTAIN GOAT	Occupied yearlong habitat						1,350	700				2,050
	Breeding/ Kidding/Nursery						1,350	700				2,050
ELK	Winter Range	2,010	2,010	1,600	2,010	2,010	2,010	2,010	2,010	130	2,010	17,810
	Calving Area						540	380	80			1,000
	Migration Routes						X	X				
MULE DEER	Winter Range	1,310	370	2,010	510	1,570	700	950	1,710	2,010	2,010	13,150
	Fall Transitional Range						370	30				400
	Migration Routes						X	X	X			

TABLE 4.19

IMPORTANT HABITATS LYING WITHIN THE ZONE OF INFLUENCE (1-MILE) OF ALL SITES PROPOSED IN ALTERNATIVE 3[2]

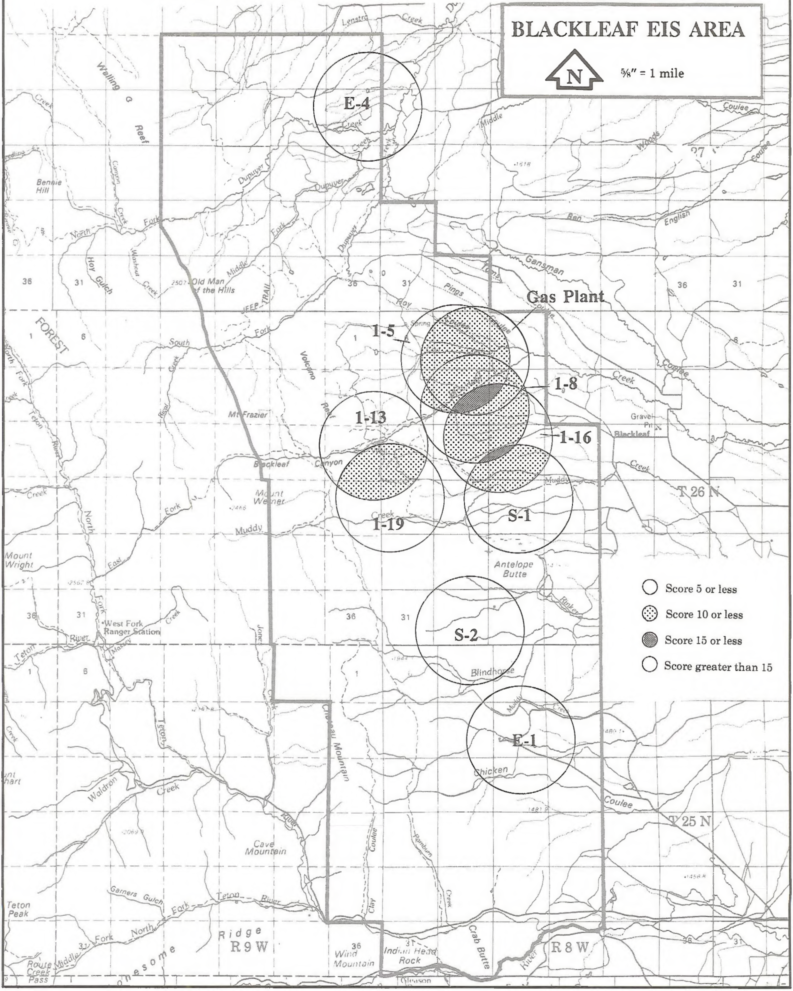
		EASTERNMOST STRUCTURE							WESTERNMOST STRUCTURE			
		Producers					Shut-in Wells		Step Out & Exploration			Total Acres
Species	Habitats	1-8	1-5	S-1	Gas Plant	Injection Well	1-13	1-19	S-2	E-1	E-4	Affected
RAPTORS	Golden Eagle						X	X	X	X		
	Prairie Falcon						X	X	X			
	Merlin			X			X	X	X	X	X	
	Acipiter Nesting Habitat (both occupied and potential)			X			X	X				
	Riparian Habitat for raptors	X	X	X	X	X	X	X	X	X	X	
	Peregrine Falcon Potential Nesting Areas						X	X	X			
	Bald Eagle Winter Concentration Area										X	
GROUSE	Sharptailed Grouse "LEK" — All three leks lie just on the eastern edge of the EIS area, possible slight impact from use of roads.											
FISH	Fisheries (if within drainage)		X				X				X	
							Total Acres/All Habitats					56,560

X — indicates that the habitat lies within the zone of influence (1-mile) of the well site or associated road or pipeline.

[1]Acres of Habitat Influenced.

[2]BLM, 1989.

Figure 4.3 Cumulative Effects on Wildlife in Alternative Three on a One-Mile Zone of Influence.



Cumulative Effects on Wildlife for Alternative 3 Based on a One-Mile Zone of Influence as Shown on Figure 4.3.

	1-8	1-5	S-1	Gas Plant	1-16	1-13	1-19	S-2	E-1	E-4
Grizzly Bear (Spring range or denning habitat)	X	X	X	X	X	X	X	X	X	X
Rocky Mountain Goat (Occupied habitat or lick)							X	X		
Bighorn Sheep (Winter range)										
Elk (Winter range)	X	X	X	X	X	X	X	X	X	X
Mule Deer (Winter range)	X	X	X	X	X	X	X	X	X	X
Raptors (Prairie Falcon or Golden Eagle occupied cliffs)						X	X	X		
SCORE	3	3	3	3	3	5	5	4	3	3

— Habitat delineations from the Interagency Rocky Mountain Front Wildlife Monitoring/Evaluation Program, BLM et al., 1987.

— Each site receives a score of one when a species habitat lies within one mile of the well location.

— Scores are cumulative when effects from two or more sites overlap.

Alternative 4

All exploration and step-out wells considered in Alternative 2, except for S-6 and S-7, have been retained in this alternative, thus most of the impacts would be similar. However, some of the more significant impacts could be lessened through: (1) construction of a gas plant allowing remote monitoring of wellsites (as discussed in Alternatives 1 and 3); (2) application of a 3½-month timing window based on site specific inspections and designed to mitigate adversity to the highest wildlife values; (3) institution of firm road management policies including restrictions and closures to the public; and (4) better road and wellsite placement at S-4 to avoid important deer winter range and spring grizzly bear riparian habitat.

As projected the exploratory wells in this alternative would result in unavoidable impacts to wildlife, in both the easternmost and westernmost geologic structures. Different timing windows would be selected for each site, based on importance of the area to the wildlife present (Figure 2.11 in Chapter 2). Site-specific analysis conducted for a particular Application for Permit to Drill (APD) may indicate the most suitable timing window based on that year's precipitation record, relative value of habitats at that particular site, or a multitude of other factors. BLM would select a 3½-month timing window within the July 15 to December 15 period.

Completing a well, including road and pad construction and drilling in 90 days or less, has not proven to be very feasible along the Rocky Mountain Front, thus the 3½-month window would be considered. Allowing more than 90 days should facilitate completing the entire process in one window, which should lessen impact to wildlife rather than having disturbance in two consecutive years. However, if the process cannot be completed in 3½-months and adherence to that period prevails, a 2-year period may be required. If an extension of a couple weeks could result in completing the drilling with fewer overall impacts to wildlife, an extension could be granted. Planning road and pad construction one year and drilling the next would be necessary at the most difficult sites. Some sites might require three windows for completion, including installation of a collection pipe.

A July 15th to October 30th timing window would probably be most acceptable for activities along the face of the Front (westernmost structure) and the more back country areas where the greatest number of important wildlife habitats overlap (see Figure 4.4). This area corresponds to the exploratory wells E-2 and E-5, all step-out wells except S-1, and the shut-in wells 1-13, 1-19, and B-1 (see Table 4.20). Producing the westernmost structure is generally most compatible to this window.

Even with this timing window (July 15 to October 30th) a number of species would be affected during some critical period (see Figure 4.4). However, except for grizzly bear, the timing window overlaps only at the beginning or end of an important period. In the case of the grizzly, riparian and berry foraging areas off the face of the Front and alpine and whitebark pine feeding sites behind the face would probably receive more use during this period. The more critical periods for Rocky Mountain goats would be avoided.

Bighorn sheep winter range/rutting areas may be affected beginning in mid-September, especially under Volcano Reef (S-5) and in areas close to the mouths of the South and North of Forks Dupuyer Creek (E-5 and S-8). Raptors could be affected during the final 2 weeks of their breeding cycles, at least for the two most prevalent species, prairie falcon and golden eagle, and nest abandonment or other harmful effects are not considered as likely as during earlier periods (Dubois and BLM, 1987). During the early and more severe winters, early mule deer migrants might also be slightly impacted.

In the area off the face of the Front, Rocky Mountain goat, bighorn sheep, and cliff-nesting raptor habitats do not overlap with grizzly bear habitat or deer and elk winter range. Thus, the latter three species are the ones of most concern and an August 15th to November 30th or September 1st to December 15th fall drilling window appears to be the best window available. Riparian areas, especially Antelope Butte Swamp, are important to grizzlies, but most of the berries found in the flatlands, principally *Shepherdia* under overstories of limber pine, should have passed their usefulness by September 1st. Therefore, bears may be spending more time following the phenology (the flowering of plants in relation to climate) of remaining green vegetation to higher elevation sites as well as searching for pine nuts and initiating their den sites. Mule deer and elk would be affected, possibly as early as late October, if harsh weather occurs that early. Hunting pressure may impede their movement onto flat lands this early. Wintering deer and elk would be most stressed later during January-March.

The long-term cumulative impacts of production over many years are the most significant and difficult to mitigate. Frequent and uncontrolled human intrusion occurring along roads to wellheads, by either the general public or company workers monitoring facilities, would significantly impact many species. Human activity at this level could possibly cause long-term avoidance of the habitats necessary to sustain a species through its yearly life cycle; the result would be the loss of individuals or perhaps whole populations.

The key to lessening the long-term impacts of production is to remotely monitor wellheads and process the gas at one plant. Reducing the number and kinds of habitats affected would not significantly change from Alternative 2 to this alternative, but the amount of negative impact during production would be significantly less.

The effects of abandonment would be similar to those discussed in Alternative 2. The differences would be that less disturbance would probably occur as fewer facilities would have to be dismantled; smaller areas reclaimed; and possibly lower quality roads may have been constructed, requiring less work to obliterate and reclaim. Less negative influence on wildlife populations may have occurred because of remote monitoring, thus, the possibility of rapid and full recovery of all wildlife would be greater.

TABLE 4.20

IMPORTANT HABITATS LYING WITHIN THE ZONE OF INFLUENCE (1-MILE) OF ALL ACTIVITIES PROPOSED IN ALTERNATIVE 4[2]

		EASTERNMOST STRUCTURE								WESTERNMOST STRUCTURE													
		Producers					Shut-In Wells			Step Out					Exploration								
Species	Habitats	1-8	1-5	S-1	Gas Plant	Injection Well	1-13	1-19	B-1	S-2	S-3	S-4	S-5	S-8	E-1	E-2	E-3	E-4	E-5	E-6	Total Acres Affected
GRIZZLY BEAR	Spring Habitat	2,010[1]	2,010	2,010	2,010	2,010	2,010	2,010	2,010	2,010	2,010	2,010	2,010	2,010	2,010	1,880	2,010	2,010	1,970	2,010	38,020
	Denning Habitat															130			40		170
ROCKY MOUNTAIN GOAT	Occupied Yearlong Habitat						1,350	700	650	110	1,510	800	1,130	280		530			70		8,040
	Mineral Lick									X				X		X			X		
	Breeding/ Kidding/ Nursery						1,350	700	650	110	1,510	800	1,130	280		530			70		8,040
BIGHORN SHEEP	Winter Range												60	40				200			430
ELK	Winter Range	2,010	2,010	1,600	2,010	2,010	2,010	2,010	2,010	2,010	2,010	2,010	2,010	2,010	130	1,930		2,010	2,010	2,010	35,820
	Calving Area						540	380	635	250	400	1,050	820	20		125			500		5,320
	Migration Routes						X	X	X												
MULE DEER	Winter Range	1,310	370	2,010	510	1,570	700	950	970	1,050	570	410	350		2,010	230	1,460	2,010			16,480
	Fall Transitional Range						370	30		300	360	100	480			1,450					3,300
	Migration Route						X	X	X							X	X				
RAPTORS	Golden Eagle						X	X	X	X	X	X	X	X	X	X	X		X	X	
	Prairie Falcon						X	X	X	X	X	X	X	X		X			X		
	Merlin			X			X	X	X	X	X	X			X	X	X	X		X	
	Acipiter Nesting Habitat (both occupied & potential)			X			X	X	X		X	X		X					X		

TABLE 4.20 (continued)

IMPORTANT HABITATS LYING WITHIN THE ZONE OF INFLUENCE (1-MILE) OF ALL ACTIVITIES PROPOSED IN ALTERNATIVE 4[2]

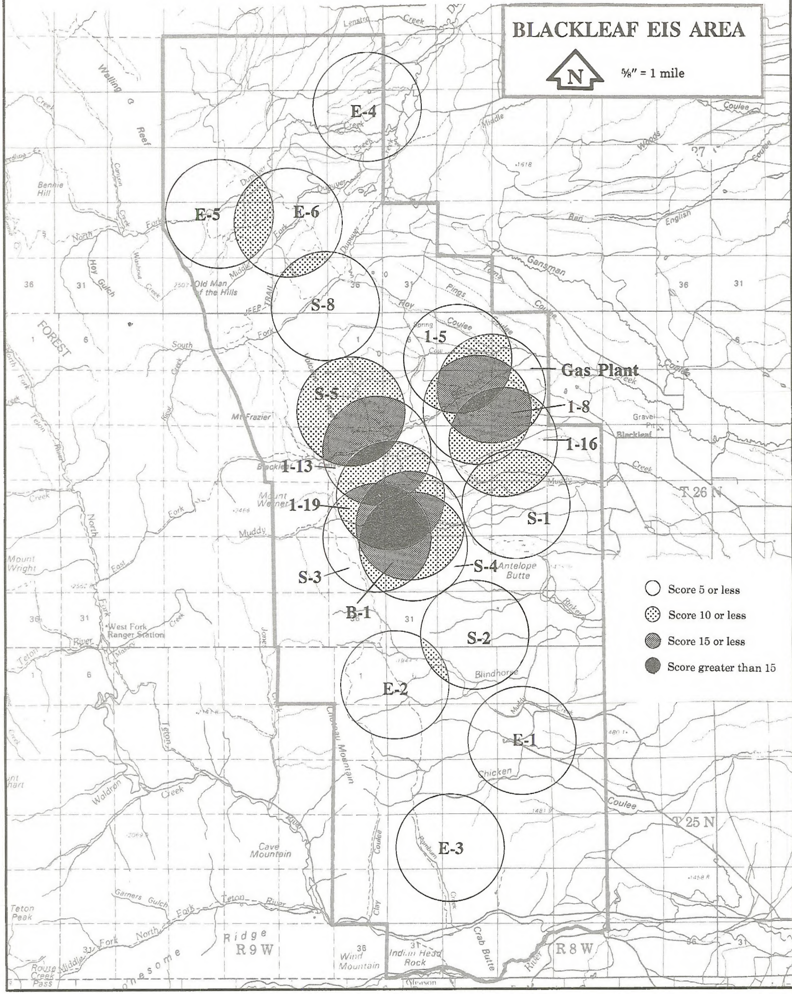
					EASTERNMOST STRUCTURE											WESTERNMOST STRUCTURE						
		Producers					Shut-In Wells			Step Out					Exploration							
Species	Habitats	1-8	1-5	S-1	Gas Plant	Injection Well	1-13	1-19	B-1	S-2	S-3	S-4	S-5	S-8	E-1	E-2	E-3	E-4	E-5	E-6	Total Acres Affected
	Riparian Habitat for Raptors	X	X	X	X	X	X	X	X	X	X	X	X		X	X		X	X	X	
	Peregrine Falcon Potential Nesting Areas						X	X	X	X	X	X	X	X						X	
	Bald Eagle Winter Concentration Area																X	X			
GROUSE	Sharptailed Grouse "LEK" — All three leks lie just on the eastern edge of the EIS area, possible slight impact from use of roads.																				
FISH	Fisheries (if within drainage)		X				X					X	X					X	X	X	
													Total Acres/All Habitats								115,620

X — Indicates that the habitat lies within the zone of influence (1 mile) of the well site or associated road or pipeline.

[1]Acres of Habitat Influenced.

[2]BLM, 1989.

Figure 4.4 Cumulative Effects on Wildlife in Alternative Four on a One-Mile Zone of Influence.



Cumulative Effects on Wildlife for Alternative 4 Based on a One-Mile Zone of Influence as Shown on Figure 4.4.

	1-8	1-5	Gas Plant	1-16	1-13	1-19	B-1	S-2	S-3	S-4	S-5	S-8	E-1	E-2	E-3	E-4	E-5	E-6	S-1
Grizzly Bear (Spring range or denning habitat)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Rocky Mountain Goat (Occupied habitat or lick)					X	X	X		X	X	X	X		X			X		
Bighorn Sheep (Winter range)											X	X					X		
Elk (Winter range)	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Mule Deer (Winter range)	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X			X
Raptors (Prairie Falcon or Golden Eagle occupied cliffs)					X	X	X	X	X	X	X	X		X			X		
SCORE	3	3	3	3	5	5	5	4	5	5	6	5	3	5	2	3	5	2	3

— Habitat delineations from the Interagency Rocky Mountain Front Wildlife Monitoring/Evaluation Program, BLM et al., 1987.

— Each site receives a score of one when a species habitat lies within one mile of the well location.

— Scores are cumulative when effects from two or more sites overlap.

OIL AND GAS

Production values for each well in each alternative were developed using the methods and information contained in Appendix E.

Alternative 1

Under Alternative 1, only 2 of 25 federal leases in the EIS area would be developed. The lessees holding the remaining 23 leases would be denied the right to develop their leases. Additional geologic and reservoir information would not be obtained for future applications.

Central production facilities would increase pipeline costs and operating costs (due to remote monitoring and maintenance costs). The ultimate recovery of producible reserves would decrease because of fluid buildup in the well bores and increased back pressure on the well and producing formation. Inline compressors could be used to decrease the back pressure, but may not be cost effective.

The reservoir produced by the 1-5 and 1-8 wells would produce between 9.4 and 18.5 BCF of the estimated 10.4 to 29.8 BCF of recoverable reserves.

The reservoir to be produced by the 1-13 and 1-19 wells would produce between 4.3 and 8.5 BCF of the estimated 7.4 to 75.8 BCF of recoverable reserves.

Between 13.7 and 27.0 BCF of the estimated 110 to 284 BCF of recoverable gas in the EIS area would be produced. Table 4.21 lists the estimated high production and low production estimates and well life for each well projected in this alternative.

Alternative 2

This alternative projects the maximum development reasonably expected. Thirteen of 25 federal leases would be developed. Wells are proposed in 10 of 11 high potential sections, 4 of 25 medium potential sections and in 1 low potential section (re-entry of a plugged well). This would result in the development, with minimal restrictions, of 6,400 high, 2,560 medium and 640 low potential acres. Substantial geologic and reservoir information would be obtained for future applications.

Because production equipment would be onsite, maximum gas recovery would occur. Equipment costs would also increase because of production equipment at each site. However, the financial gain from the additional reserves recovered would more than offset these costs. Pipelining expenses would decrease.

The reservoir produced by the 1-5 and 1-8 wells would have an additional well drilled (S-1). Total recovery from this reservoir is estimated between 10.4 and 29.8 BCF.

The reservoir to be produced by the 1-13 and 1-19 wells would be further evaluated by up to eight step-out wells. Production estimates for this reservoir range from 7.4 to 75.8 BCF. Total recovery from both reservoirs is estimated between 17.8 and 105.6 BCF.

Table 4.22 lists the estimated high production and low production estimates and well life for each well projected under Alternative 2.

TABLE 4.21

ESTIMATED PRODUCTION[1]
ALTERNATIVE 1

Well Number	Location	Estimated High Production	Estimated Low Production	Dates Based on High Production Under this Alternative
1-5	5-26N-8W	8.7 BCF	4.4 BCF	1983-2011
1-8	8-26N-8W	9.8 BCF	5.0 BCF	1983-2012
1-13	13-26N-9W	4.1 BCF	2.1 BCF	1991-2013
1-19	19-26N-8W	4.4 BCF	2.2 BCF	1991-2014
Totals		27.0 BCF	13.7 BCF	

[1]BLM, 1989.

TABLE 4.22

ESTIMATED PRODUCTION[1]
ALTERNATIVE 2

Well Number	Location	Estimated High Production	Estimated Low Production	Dates Based on High Production Under this Alternative
1-5	5-26N-8W	9.7 BCF	4.9 BCF	1983-2012
1-8	8-26N-8W	10.9 BCF	5.5 BCF	1983-2013
1-13	13-26N-9W	5.5 BCF	2.8 BCF	1991-2016
1-19	19-26N-8W	5.8 BCF	2.9 BCF	1991-2016
B-1	19-26N-8W	3.5 BCF	1.7 BCF	1991-2012
S-1	21-26N-8W	9.2 BCF	0*	1992-2021
S-2	32-26N-8W	14.7 BCF	0	1992-2025
S-3	24-26N-9W	4.5 BCF	0	1992-2015
S-4	30-26N-8W	13.8 BCF	0	1993-2025
S-5	12-26N-9W	8.0 BCF	0	1993-2021
S-6	1-26N-9W	10.0 BCF	0	1993-2022
S-7	2-26N-9W	4.7 BCF	0	1994-2017
S-8	35-26N-9W	5.3 BCF	0	1994-2018
E-1	9-25N-8W	0**	0	1994
E-2	6-25N-8W	0	0	1995
E-3	20-25N-8W	0	0	1995
E-4	13-27N-9W	0	0	1995
E-5	27-27N-9W	0	0	1996
E-6	26-27N-9W	0	0	1996
	Totals	105.6 BCF	17.8 BCF	

*This represents the possibility of the well being a dry hole.
**This assumes the well to be a dry hole.
[1]BLM, 1989.

Alternative 3

Oil and gas development drilling would be severely limited under this alternative. Four of 25 federal leases would be developed. Only two medium potential and two high potential sections would be drilled. Additional geologic and reservoir information obtained for future applications would be minimal.

Based on the Rocky Mountain Front Guidelines, leases within Segment A of Figure 2.7 could not realistically be developed because of overlapping timing restrictions. Leases within Segment B of Figure 2.7 would have a short timing window of 90 to 120 days in which to perform drilling activities. The remaining 10 percent of the EIS area would be available for development subject to the Endangered Species Act restrictions and standard management practices. Timing restrictions based on RMFWG would delay drilling, pipelining, and possibly work over activities. Delays of this type increase costs, delays and possibly decrease production quantities and may result in the premature abandonment of producing wells.

Central production facilities would cause the same impacts as those discussed in Alternative 1.

The reservoir being produced by the 1-5, 1-8 and S-1 wells would produce between 9.4 and 25.4 BCF of gas. This represents a 1.0 to 4.4 BCF reduction in produced reserves compared to Alternative 2.

Only one additional well (S-2) would be drilled in the reservoir containing the 1-13 and 1-19 wells. Total production from this reservoir would range between 4.3 and 19.5 BCF. Potentially, 2.9 to 56.3 BCF of reserves would not be produced.

Between 13.7 and 44.9 BCF of the estimated 110 to 284 BCF within the EIS area would be produced under this alternative.

Table 4.23 lists the high production and low production estimates and well life for each well projected in this alternative.

TABLE 4.23

ESTIMATED PRODUCTION[1]
ALTERNATIVE 3

Well Number	Location	Estimated High Production	Estimated Low Production	Dates Based on High Production Under this Alternative
1-8	8-26N-8W	8.7 BCF	4.4 BCF	1983-2011
1-5	5-26N-8W	9.8 BCF	5.0 BCF	1983-2012
1-13	13-26N-9W	4.1 BCF	2.1 BCF	1991-2013
1-19	19-26N-8W	4.4 BCF	2.2 BCF	1991-2014
S-1	21-26N-8W	6.9 BCF	0*	1991-2017
S-2	32-26N-8W	11.0 BCF	0	1992-2022
E-1	9-25N-8W	0**	0	1991
E-4	13-27N-9W	0	0	1992
	Total	44.9 BCF	13.7 BCF	

*This represents the possibility of the well being a dry hole.
**This assumes the well to be a dry hole.
[1]BLM, 1989.

Alternative 4

Under Alternative 4, 12 of 25 federal leases would be developed. Eight high potential, four medium potential and one low potential sections would be drilled. Substantial geologic and reservoir information would be obtained for future applications.

Compared to Alternative 2, two wells (S-2 and S-4) have been moved and two wells (S-6 and S-7) have been dropped. In the case of S-2, a small production decrease (0.1 BCF) results. In the S-4 case, substantial reserves would not be produced (10.0 BCF).

Timing restrictions proposed under this alternative would cause the same impacts as those discussed in Alternative 3, but to a lesser degree.

Central production facilities would cause impacts similar to those discussed in Alternative 1.

The reservoir being produced by the 1-5, 1-8, and S-1 wells would produce between 9.4 and 25.4 BCF of gas.

The reservoir to be produced by the 1-13, 1-19, B-1, S-2, S-3, S-4, S-5 and S-8 wells would produce between 5.6 and 42.8 BCF.

Total production from both reservoirs is estimated to range between 16.3 and 68.2 BCF.

Table 4.24 lists the high production and low production estimates and well life for each well projected in Alternative 4.

TABLE 4.24

ESTIMATED PRODUCTION[1]
ALTERNATIVE 4

Well Number	Location	Estimated High Production	Estimated Low Production	Dates Based on High Production Under this Alternative
1-5	5-26N-8W	8.7 BCF	4.4 BCF	1983-2011
1-8	8-26N-8W	9.8 BCF	5.0 BCF	1983-2012
1-13	13-26N-9W	4.1 BCF	2.1 BCF	1991-2013
1-19	19-26N-8W	4.4 BCF	2.2 BCF	1991-2014
B-1	21-26N-8W	2.6 BCF	1.3 BCF	1992-2011
S-1	21-26N-8W	6.9 BCF	0*	1992-2018
S-2	32-26N-8W	14.5 BCF	0	1993-2025
S-3	24-26N-9W	3.4 BCF	0	1993-2014
S-4	19-26N-8W	3.8 BCF	0	1994-2016
S-5	12-26N-9W	6.0 BCF	0	1994-2019
S-8	35-26N-9W	4.0 BCF	0	1995-2017
E-1	9-25N-8W	0**	0	1996
E-2	6-25N-8W	0	0	1996
E-3	20-25N-8W	0	0	1997
E-4	13-27N-9W	0	0	1998
E-5	27-27N-9W	0	0	1998
E-6	26-27N-9W	0	0	1999
	Totals	68.2 BCF	15.0 BCF	

*This represents the possibility of the well being a dry hole.
**This assumes the well to be a dry hole.
[1]BLM, 1989.

SURFACE WATER

Alternative 1

This alternative would result in two additional gas pipelines connecting the existing wells. Constructing these pipelines would create excavated spoil that could erode. However, there is little surface water in most areas along the pipeline route because precipitation sinks rapidly into the thick beds of gravel. Minor erosion would be expected only in or adjacent to the floodplain of Blackleaf Creek because that is the only place along the pipeline route where streamflow is carried from the mountains.

The overall impacts would be minor.

Alternative 2

This alternative assumes substantial construction or surface disturbance in order to accommodate oil and gas development, creating a moderate possibility for soil erosion and subsequent sedimentation; particularly in the more erodible land types. Much of the area, notably land type 204 (benches, fans and terraces of gravel alluvium), has little surface water because precipitation or runoff sinks rapidly into the thick beds of gravel. Erosion would be expected from construction in or adjacent to the floodplains (land type 200, defined in Appendix I) of Blackleaf Creek, Muddy Creek, Clark Fork Muddy Creek, Chicken Coulee, and the forks of Dupuyer Creek.

Other land types with high potential for sediment impacts to water quality include 201 (wetlands), 161 (certain mountain foothills), and 14D (rotational slumps and mudflows). Wetlands are especially sensitive to construction impacts and activity in these areas must include restrictions for protecting wetlands. This alternative would allow only a short stretch of road reconstruction in wetlands. Land type 161 has some erosion hazard, but would deliver little sediment to streams. Land type 14D is more extensive, mostly in front of the limestone reefs (cliffs) that dominate the landscape, but little erosion or other soil movement would be delivered to a flowing stream. When sediment is delivered to the stream from these land types, it is often soon deposited by the stream along with other material from the floodplain.

Alternative 3

This alternative provides for minimal construction or surface disturbance, creating a low possibility for soil erosion and subsequent sedimentation in the more erodible land types.

The impacts to soil types 14D, 161, 200 and 204 would be proportionally similar to those described in Alternative 2.

Alternative 4

This alternative is similar to Alternative 2 in that there would be substantial construction and/or surface disturbance in order to accommodate oil and gas development, creating a moderate possibility for soil erosion and subsequent sedimentation, particularly in the more erodible land types. However, there would be less soil erosion and sedimentation in this alternative than Alternative 2, because there would be two fewer wells in this alternative.

GROUNDWATER

Alternative 1

Laying the pipelines from the 1-13 and 1-19 wells would involve trenching through talus and colluvial and alluvial outwash. This could produce a temporary lowering of groundwater levels in the trench itself. It would also create a temporary increase in the turbidity and sediment in the groundwater. This would not create any impact at depth or off site because of the filtering effect of these soil types. After backfilling the trench, there would be no lasting impacts.

In the event of a pipeline leak or rupture, minor amounts of produced condensate and associated saltwater would escape and would rise to the surface like a spring. In this alternative, the maximum amount of fluid to escape is estimated at less than 20 barrels. The fluid would flow on the surface and portions would percolate into the subsurface aquifers such as along Blackleaf Creek.

Pipeline leaks are generally the result of corrosion (15 percent), damage from external source (40 percent), material defects and construction (40 percent) and 5 percent miscellaneous causes (Layton, D. W. et al. 1984). In general, 6 percent of the leaks occur along field gathering lines, 87 percent along transmission lines and 7 percent at compressor stations, dehydration and metering stations (Layton, D. W. et al. 1984). The pipelines from the 1-13 and 1-19 wells to the production facilities would be field gathering lines and have the fewest incidences of occurrence. The greatest probability of leaks would be the transmission line from the processing facility to the Montana Power pipeline, east of the EIS area.

If a pipeline rupture were to occur, the pressure-activated block valves on both sides of the ruptured portion of pipe close, causing an atmospheric discharge that decreases with time until the pressure within the pipe equals atmospheric pressure. Gas released from such failures would disperse in the form of an elongated puff or cloud (Layton, D. W. et al. 1984).

The probability of a field gathering pipeline leak would be .00076 leaks per mile of pipeline per year (Layton, D. W. et al. 1984). The probability of a transmission line leak would be .0018 leaks per mile of pipeline per year.

Alternative 2

The quality of groundwater intercepted during road and drill pad construction would be lowered by introducing sediment. This would be a minor impact because of the filtering effect the alluvial gravels and because little groundwater would be expected. Compaction of the road surface and drill pad would cause less infiltration and more runoff, and possibly a decreased rate of recharge. This would also be a minor impact because of the small surface acreage involved and eventual site reclamation.

Construction work in cretaceous age shales, silts and thin sandstones (E-1, E-3, E-4, E-5, E-6, S-1, S-2, S-4, S-5, S-6 and S-7) could intercept ground water and temporarily increase the turbidity. This would be a minor impact because of the low volumes of groundwater expected and the filtering effect of the water percolating back into the ground.

Construction work in unconsolidated alluvium (S-3 and S-8) would also intercept groundwater and temporarily lower groundwater quality by increasing turbidity. Because of the filtering action of these gravels, this would be a minor impact.

Construction work in Mississippian limestone (E-2) would intercept and divert groundwater to the surface. This would also be a minor impact because of the small area involved and because the intercepted water would infiltrate back into the subsurface.

Drilling fluids could enter subsurface aquifers and temporarily lower groundwater quality. This would be a localized impact that would last only during the actual drilling operation.

Seepage from mud pits during drilling could contaminate groundwater in the vicinity of the drilling site. Drilling muds consist of bentonite clay, various hazardous and non-hazardous additives and traces of contaminants such as diesel fuel and oil.

Drill sites S-3 and S-8 would be located in unconsolidated alluvial gravels, which are very porous and water readily percolates in them. Mud pits constructed on the porous gravels could cause significant groundwater contamination, unless lined.

Drill site E-2 would involve placing mud pits on Mississippian limestone. The porosity of the limestone varies considerably. In general, drilling fluids would tend to plug pore spaces and not travel off site. Groundwater could be affected, however it would not be significant.

The discussion of pipeline leaks (chance of occurrence, impacts, etc.) as discussed in Alternative 1 also applies to this alternative.

Alternative 3

Should groundwater be intercepted during road and drill pad construction, the quality would be lowered by introducing sediment. This would not be expected to have any impact at depth or off site because of the filtering effect of the alluvial gravels. Compaction of the road surface and drill pad would cause less infiltration and more runoff, and possibly a decrease in the rate of recharge. This would not be significant because of the small surface acreage involved and eventual site reclamation.

Drill sites E-1, E-4, S-1 and S-2 would all involve road and drill pad construction in Cretaceous age shales, silts and thin sandstones. Which contain minor amounts of groundwater. If this construction work should intercept groundwater, the water quality would be temporarily lowered by sediment entering exposed water during construction. This would not be significant because of the expected low volumes and the filtering effect once the water percolates back into the ground.

Overall, the impacts (drilling operations, mud pits, production and abandonment) would be proportionally similar to those described in Alternative 2.

The discussion of pipeline leaks (chance of occurrence, impacts, etc.) as discussed in Alternative 1 also applies to this alternative.

Alternative 4

The impacts to groundwater from this alternative would be similar to those described in Alternative 2. However, this alternative assumes two fewer wells than Alternative 2 and thus, similar but fewer impacts.

RECREATION

Alternative 1

The greatest impact created by this alternative would be construction noise heard by recreationists.

Pipeline construction activities would temporarily increase the amount of heavy equipment and vehicle traffic on existing access routes, which could inconvenience some recreationists. These activities would also increase the amount of equipment and vehicle noise heard by recreationists. These impacts would be minor and short-term.

Summer activities such as camping, motorcycle travel, horseback riding, hiking, and picnicking would be temporarily impacted. Most of this activity is spread over a large area and the interaction between construction activity and recreation activity would be minimal.

Winter recreation would not be affected, unless some phase of construction takes place during the winter. If this were to occur, it would be a minor impact.

Access to Forest Trail No. 106 and the adjacent facilities (picnic area, stock ramp and outhouse) in Blackleaf Canyon may be curtailed during the pipeline construction phase for the 1-13 well, possibly limiting recreation access and uses in that area during that time. People could hear this activity and may or may not be bothered, depending on the individual. However, the impact would be minor and short term.

The only affect to the Teton Roadless Area would be bringing the existing 1-13 gas well into production by placing a buried pipeline adjacent to the road for a distance of approximately 1,200 feet. The characteristics of the area would not be altered since the well and road already exist.

Alternative 2

Road construction to the S-3 wellsite would reduce 80 acres from a semi-primitive to a roaded-natural setting. This could change the recreation expectations of both the public and land managers.

Road reconstruction would make existing routes more accessible and new road construction would increase motorized access into areas that were previously inaccessible.

Such construction or upgrading of existing roads could be viewed in two ways. Some people may view increased accessibility to areas previously inaccessible as an opportunity to enhance and increase recreation uses and use areas, particularly hunting and hiking. Others may view it as a detriment to recreation in that quality hunting or recreation opportunities for the area may be diminished due to increased accessibility and vehicle travel.

Although snow conditions are generally not favorable in this area for snowmobile and cross-country skiing activities, increased access could enhance those types of recreation uses.

Four step-out wells and one exploratory well would be drilled in the Teton Roadless Area. A total of 5.9 miles of new road along the eastern border of the roadless area would be constructed to serve the potential wellsites. The wells would be located in the foothills below the limestone cliffs which create a physical barrier between potential well development and the rest of the roadless area. With the exception of this activity occurring along the northeastern portion of the area, the Teton Roadless Area would remain roadless and retain its associated characteristics. Nevertheless, some would argue that access of any kind is an intrusion that is incompatible with the area's existing character.

Those recreationists seeking solitude in the vicinity of development activities would be displaced by the sights and sounds associated with exploration.

Alternative 3

The impacts of this alternative would be similar to those described in Alternative 1. However, the potential for such impacts would increase slightly because of the increased activity in this alternative.

The short segment of new road construction could be viewed as a positive or negative impact as discussed in Alternative 2.

Alternative 4

The impacts of this alternative would be similar to those described in alternative 2. However, the potential for such impacts would decrease slightly because of the access management portion of this alternative and because this alternative projects two fewer wells than Alternative 2.

VISUAL RESOURCES

Alternative 1

This alternative would create the fewest impacts to visual resources.

As very little new surface disturbance would occur, the status quo of the area would be very nearly retained and in some instances improved. Most of the activities projected would be in keeping with current management activities, which include roads and associated oil and gas and ranch buildings and operations.

Dismantling the facilities at the 1-8 and 1-5 wells would improve the visual qualities, especially in foreground and middle ground views. The new gas processing plant would nearly be hidden from middle and background views because of the screening effect of the surrounding hills. The plant would only be noticeable from the road into the plant or the adjacent Blackleaf Creek drainage. Pipelines to the plant would result in short-term visual contrasts.

The existing wells and roads have been designed to fit into the landscape or are on flat land screened by topography and trees.

Alternative 2

Significant impacts to visual quality would occur with construction of the roads to the E-2, S-2, and S-5 wellsites. These roads would require a number of switchbacks through forested areas. The impacts from both of these roads would be noticeable to all viewers, fore, middle and background. As the S-5 wellsite would be located in an area with a Class III visual resource management (VRM) objective (allow visual contrast, activities may be noticeable) on the Lewis and Clark National Forest, it would be at an acceptable level, even with the noticeable scenic deterioration. The roads to the E-2 and S-2 wellsites cross through the BLM's Blind Horse Outstanding Natural Area. This area has a Class I VRM objective (all activities should be unnoticeable or blend with the landscape) and no amount of design or mitigation would reduce the visual impacts of this road to an acceptable level for this rating. Thus, a BLM Area Manager's override would be required for these projects to proceed. The main impacts would be due to the continuous forest type found here and the number of switchbacks required to climb the imposing steep face of the Rocky Mountain Front.

The roads to and the wellsites for the E-3, S-6 and S-7 wells would create visual impacts due to the elevation and landscape types. However, only short sections of these roads should be noticeable. Mitigation of wellpads should reduce impacts to a low level for middle and background views and to an acceptable level for foreground views.

Since this alternative employs a number of facilities at each wellsite, the foreground view would be impacted.

If all the projected roads and facilities were built there would be an obvious visual contrast to what is viewed currently. However, all sites, except the E-2 and S-5 wellsites, may be acceptable to the average viewer.

Alternative 3

Since this alternative eliminates the majority of wellsites and roads which create visual impacts and adopts a remote monitoring design for well operation, there would be few impacts. The small limited facilities required for remote monitoring should blend in with the surrounding landscape.

Short-term impacts from pipelines may occur, but prompt rehabilitation and vegetation would limit these impacts in the long term.

The impacts from gas plant construction would be the same as found in Alternative 1.

Overall, the visual impacts of this alternative would be similar to, although greater than Alternative 1 due to the additional number of roads and wellsites.

Alternative 4

This alternative projects 12.25 miles of new road, 18 drill pads and 11.4 miles of road to be upgraded.

This would result in overall moderate visual impacts to the area with some fairly localized areas of significant impact. In all cases except two, construction of roads, drill pads and facilities should be within acceptable visual guidelines of the agencies. The exceptions would be the roads to the E-2 and S-2 drill sites located with the BLM's Blind Horse Outstanding Natural Area. These roads would essentially split the ONA and exceed VRM standards for this Class I area. This would therefore require a BLM Area Manager's override for these projects to proceed.

The elimination of most wellsite facilities would significantly reduce the point source problems associated with man made structures in a natural environment. Elimination of the switchback road to the S-3 well would reduce visual impacts from the main Blackleaf road. The new road to both the S-2 and S-4 wells south of Muddy Creek, would create moderate impacts to visual quality.

The new gas processing plant located on Blackleaf Creek would be virtually invisible from most major travel routes due to its location. Only the foreground view should be affected.

In summary, with the exception of the E-2 and S-2 roads, all proposals in this alternative are within Visual Resource Management thresholds.

NOISE

Alternative 1

The sources of the increased noise levels would include heavy equipment during the pipeline construction period (4 to 6 months) and traffic on access roads. All of these noises would be short-term.

Noise impacts from a gas plant would be minimal except during the brief construction phase (4 to 6 months), and from infrequent maintenance-related vehicular traffic.

Alternative 2

The noise level would increase in the immediate vicinity of any new wellsites and access roads. The sources of increased noise levels would include heavy equipment used during road construction, pad construction, development, production and abandonment. Most of these noises would be short-term.

Any additional drilling operations, and access road use (both during drilling and field maintenance) would be a minor noise nuisance to recreational users of the area due to its small (1/4 to 1/2 mile) influence zone and temporary 4 to 6-month nature.

Any additional drill operations and access road use could tend to drive wildlife from 1/4 to 1/2-mile from wellsites and access roads. For individual wellsites, this impact would not be significant; however, for a developing field, these influence zones could overlap and may have an adverse affect on wildlife. The potential also exists for access road influence zones to affect migratory routes for big game.

The noise impact areas (areas where wildlife displacement and nuisance users would occur) are displayed on Figure 4.5 and would be similar for all the alternatives.

Alternative 3

These impacts would be proportionally similar to those described in Alternative 1.

Alternative 4

These impacts would be similar to those described in Alternative 2.

TRANSPORTATION SYSTEM

Alternative 1

This alternative would not require any additional reconstruction or construction of roads as adequate access currently exists. Also, this alternative would not require any additional access roads across private land holdings. There should be no additional impacts to the road system as overall road use would not increase.

Alternative 2

This alternative would require 12.85 miles of reconstruction to provide access for the proposed exploratory and step-out wells. These improvements would consist of improving the road template to reduce erosion problems, improving surface drainage, and minimizing additional sedimentation. Some minimal road alignment improvements would also be required to allow safe use by a typical medium-depth drilling vehicle and its support vehicles.

An additional 12.85 miles of new road system would be constructed to provide access to exploratory and step-out wells. These roads would consist of a 14-foot travelway located on grades in the range of 6 percent with brief pitches in the 10-percent range.

Because this alternative does not provide for road management, there is the potential for significant impacts to the road system from unlimited vehicle use by the public. Roads would tend to "washboard" and rutting during wet periods could be a significant problem. The unit operator would be most impacted and would necessarily spend extra time maintaining roads.

Alternative 3

This alternative would require 1.75 miles of reconstruction to provide access for the proposed exploratory and step-out wells. These improvements would be the same as those discussed in Alternative 2.

An additional 1.25 miles of new road system would be constructed to provide access to the federal S-2 well. This road would consist of a 14-foot travelway located on grades in the range of 6 percent with brief pitches in the 10-percent range.

This alternative would require constructing about 1.0 mile of access road across private land holdings. The road section accessing site E-4 is a portion of the North Fork of Dupuyer Creek Road which has been identified for rights-of-way acquisition in the Lewis and Clark Forest Plan. This road has been identified as a high priority acquisition for providing public access to National Forest lands and this road segment should be retained for that purpose. The road accessing producing wells 1-8 and 1-13 known as Blackleaf Road has also been identified for retention for access needs.

The general impacts would be similar to those described in Alternative 2. However, there would be fewer impacts because of less new road construction and reconstruction and the proposed road management system.

Alternative 4

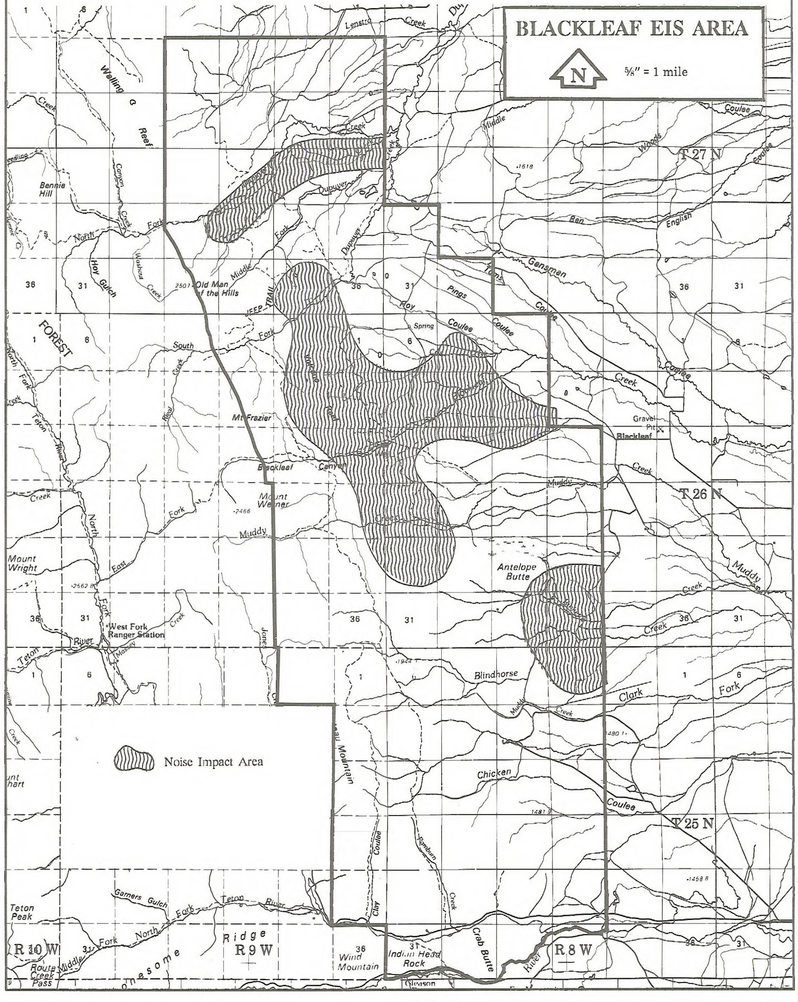
This alternative would require 11.4 miles of reconstruction to provide access for the proposed exploratory and step-out wells. These improvements would be the same as discussed in Alternative 2.

An additional 12.25 miles of new road system would be constructed to provide access to exploratory and step-out wells. These roads would consist of a 14-foot travelway located on grades in the range of 6 percent with brief pitches in the 10-percent range.

Access roads would cross several private land holdings. This alternative would require about 15.3 miles of access road across various private landowners in the EIS area. The road accessing site E-5, which is known as the North Fork of Dupuyer Creek Road crosses the Boone and Crockett Club land and has been identified for rights-of-way acquisition in the Lewis and Clark Forest Plan. This road has been identified as a high priority acquisition for providing public access to National Forest lands. The road presently accessing producing wells 1-13 and 1-8, which is known as the Muddy Creek road, has also been identified as a future access need. The Bureau of Land Management has identified the lower portion of the Chicken Coulee road as a future desired access route for trail head development. This facility would be used to provide additional public access into the Blind Horse Creek Outstanding Natural Area.

These impacts would be similar to those discussed in Alternative 2. However, the road management component of the alternative significantly lessens those impacts.

Figure 4.5 Noise Impact Area.



SOCIAL AND ECONOMIC

Alternative 1

Employment

Constructing a gas processing facility and bringing two shut-in wells on line would provide temporary employment opportunities in the construction and transportation sectors of the economy. Employment opportunities could occur as early as 1990, when 102 jobs could be available for a short time. This would include those jobs directly associated with construction and other jobs supported by local expenditures. These jobs would be filled primarily by local employees. Local expenditures for goods and services could amount to $1,026,000 for construction of pipelines and facilities, dependant upon the availability of oil and gas support services in the area. Many of the job opportunities would be provided by existing services in Teton, Glacier and Cascade Counties. Table 4.25 shows employment associated with this alternative.

Production related employment would occur in the regional area. Field maintenance crew and support personnel would be needed: truckers, pumpers, and repair/custodial personnel. The number of direct workers at this stage of activity could be five with another seven indirect workers. This activity would benefit the existing oil and gas service and retail trade sectors (see Table 4.25).

Population

Development of natural gas could result in minor impacts to the community of Choteau, resulting from population growth associated with temporary nonlocal workers. This would occur during pipeline and facility construction as early as 1990.

The communities of Dupuyer and Bynum could also experience some short-term changes with immigration of temporary workers. Dupuyer and Bynum are close to the Blackleaf EIS area (10 to 20 miles), but do not have the services, housing and infrastructure that are available in Choteau.

Personal Earnings

The communities where workers would reside could experience a minor increase in economic activity during pipeline and facility construction. This would occur as a result of employees payroll expenditure and through company expenditures for goods and services. The impact on regional personal earnings for the period 1990 to 2000, is shown in Table 4.26.

TABLE 4.25

ESTIMATED PROJECT-RELATED EMPLOYMENT OPPORTUNITIES[2]
ALTERNATIVE 1

	Development/Activities			Production	
Year	Number of Wells Drilled	On-site Full-Time Jobs Lasting 30-90 Days	Part-time Jobs Lasting up to 120 Days	Number of Producing Wells	Number of Direct and Indirect Jobs
1990	0	0	102[1]	4	12
1991	0	0	0	4	12
1992	0	0	0	4	12
1993	0	0	0	4	12
1994	0	0	0	4	12
1995	0	0	0	4	12
1996	0	0	0	4	12
1997	0	0	0	4	12
1998	0	0	0	4	12
1999	0	0	0	4	12
2000	0	0	0	4	12

[1]Employment associated with construction of the gas processing facility and bringing the two shut-in wells on line.

[2]BLM, 1989.

Chase, R.A., et al. 1982. Expansion and Adaptation of the North Dakota Economic-Demographic Assessment Model (NEDAM) for Montana: Technical Description. Agricultural Economics Miscellaneous Report no. 61. North Dakota Agricultural Experiment Station, North Dakota State University, Fargo, N.D. 225p.

Wenner, L.N. 1981. Social and Economic Assessment of Oil and Gas Activities: Information and Guidelines. USDA Forest Service Northern Region. R1 81-01 84p.

TABLE 4.26

PROJECTED INCREASE IN ANNUAL REGIONAL EARNINGS
(1986 dollars)[1]
ALTERNATIVE 1

Year	Development Earnings	Production Earnings	Total
1990	608,000	183,000	791,000
1991	0	183,000	183,000
1992	0	183,000	183,000
1993	0	183,000	183,000
1994	0	183,000	183,000
1995	0	183,000	183,000
1996	0	183,000	183,000
1997	0	183,000	183,000
1998	0	183,000	183,000
1999	0	183,000	183,000
2000	0	183,000	183,000

Note: The regional area is defined as Cascade, Glacier, Lewis and Clark, Pondera, and Teton counties.

[1]BLM, 1989.

Chase, R.A., et al. 1982. Expansion and Adaptation of the North Dakota Economic-Demographic Assessment Model (NEDAM) for Montana: Technical Description: Agricultural Economics Miscellaneous Report no. 61. North Dakota Agricultural Experiment Station, North Dakota State University, Fargo, ND. 225p.

Housing

The temporary demand for housing during construction of facilities and pipelines, could cause a minor impact in Choteau. Temporary workers generally prefer apartments, motels, mobile homes, or recreational vehicles. Most of these workers seek lodging as close to the work site as possible or within the current boundaries of, or adjacent to, incorporated towns. This reflects the service, trade, housing supply, and governmental infrastructure presently available.

Public Finance

The principle long-term fiscal affect to the economy from natural gas production would be public revenues. Production taxes on natural gas would benefit Teton County and the state. Table 4.27 shows estimates of natural gas produced from the Blackleaf EIS area and the associated royalties and taxes from 1990 to 2000.

Social Conditions

This alternative would result in minor short-term changes in employment, personal earnings and housing in the regional area of influence. While there may be individual or personal benefits associated with these changes, there is also the potential for adverse social effects; these impacts should be insignificant.

The population analysis indicates this alternative would not cause demographic changes in the area. In terms of ability to deal with potential social problems, an important community resource is the prior experience with oil and gas exploration and development. The area has had experience with exploration and development in the Blackleaf EIS area. During the last 7 years five wells were drilled, two of which are currently producing and two that are shut-in, but capable of production.

TABLE 4.27

ESTIMATE OF NATURAL GAS PRODUCED FROM THE BLACKLEAF EIS AREA
THE ASSOCIATED ROYALTIES AND STATE TAXES
(valued at $1.42/MCF)[4]
1990-2000
ALTERNATIVE 1

Year	Production MCF	Gross Value ($1.42/MCF)	Federal Mineral Receipts[1]	State Mineral Receipts[2]	Natural Gas Production Taxes[3]
1990	795,000	1,128,900	94,300	9,600	142,200
1991	1,918,400	2,724,100	251,900	17,900	301,300
1992	1,726,500	2,451,700	226,800	16,100	335,800
1993	1,553,900	2,206,500	204,200	14,500	302,200
1994	1,398,500	1,985,800	183,800	13,100	272,000
1995	1,258,600	1,787,300	165,500	11,800	244,800
1996	1,132,800	1,608,500	149,000	10,600	220,300
1997	1,019,500	1,447,700	134,200	9,600	198,300
1998	917,500	1,302,900	120,800	8,600	178,500
1999	825,800	1,172,600	108,800	7,800	160,600
2000	743,200	1,055,400	98,000	7,000	144,500

Note: This information is based on probable production from producing wells. The actual could vary significantly from that shown.

[1]Assumes a federal royalty rate of 12.5 percent plus lease payments.
[2]Based on the states participation in the Blackleaf unit and assumes a state royalty rate of 12.5 percent plus lease payments.
[3]This includes the resource indemnity trust tax, gas producers privilege and license tax, natural gas severance tax and net proceeds tax.
[4]BLM, 1989.

Alternative 2

Employment

Oil and gas development within the Blackleaf EIS area would provide short and long-term employment opportunities in the construction and transportation sectors of the economy. This employment would occur for relatively short time periods during drilling operations. The greatest impact to the area would likely occur in 1990, 1993, and 1994, when 209, 118, and 200 jobs, respectively, would be project related. Table 4.28 shows the employment associated with this alternative.

At the peak development period there would be approximately 50 full time jobs in 1990 and 1993, and 75 full time jobs in 1994 for 30 to 90-day time periods. The full time jobs would be located at two drilling sites in 1990 and 1993, and three drilling sites in 1994. These workers would include the drill rig crew, mud loggers and tool pushers. Peak local annual expenditures for goods and services would be $1,896,000 in 1994, $1,570,000 in 1990, and $1,530,000 in 1993 for drilling and road/pipeline construction. Local expenditures would depend upon the availability of oil and gas support services in the area and actual surface and subsurface conditions encountered at the time a well is drilled. These expenditures could support 159 short-term jobs in 1990, 113 short-term jobs in 1993, and 125 short-term jobs in 1994. This would include those jobs directly associated with construction and other jobs supported by local expenditures. Increases in employment opportunities would cause immigration of workers for the drill rig crew, tool pushers and mud loggers while jobs in construction, transportation and oil/gas services would benefit the existing service sectors in the regional area (see Table 4.28).

Peak road and pipeline activity would be expected in 1990, 1993 and 1994, when there would be approximately 110, 47 and 55 construction jobs, respectively, expected for approximately 120 days. These jobs would be filled primarily by local employees. There would be approximately $1,653,000 in local expenditures from construction and drilling at two well sites in 1992.

Jobs in construction, transportation and oil/gas services would be expected in Teton, Glacier and Cascade Counties. In terms of increased numbers employed and the settlement pattern of nonlocal temporary workers, employment impacts related to development and exploration would occur primarily in Choteau, in Teton County. The greatest impact to Choteau would occur during the peak development periods when 50 temporary workers in 1990 and 1993, and 75 temporary workers in 1994, associated with on site drilling, would be within the immediate area and another 11-15 short-term workers in support services. Other communities in the area could also experience some short-term changes with immigration of temporary workers and increased employment opportunities. Temporary construction crews may not generate much local secondary employment; there are limits to how rapidly facilities and services can expand or would expand to accommodate temporary employees.

TABLE 4.28

ESTIMATED PROJECT-RELATED EMPLOYMENT OPPORTUNITIES[1]
ALTERNATIVE 2

	Development/Activities			Production	
Year	Number of Wells Drilled	On-site Full-Time Jobs Lasting 30-90 Days	Part-time Jobs Lasting up to 120 Days	Number of Producing Wells	Number of Direct and Indirect Jobs
1990	2	50	159	6	15
1991	1	25	14	7	17
1992	2	50	72	9	19
1993	2	50	113	11	22
1994	3	75	125	13	25
1995	1	50	75	13	25
1996	1	25	14	13	25
1997	1	25	19	13	25
1998	1	25	16	13	25
1999	0	0	0	13	25
2000	0	0	0	13	25

[1]BLM, 1989.

Chase, R.A., et al. 1982. Expansion and Adaptation of the North Dakota Economic-Demographic Assessment Model (NEDAM) for Montana. Technical Description: Agricultural Economics Miscellaneous Report no. 61. North Dakota Agricultural Experiment Station, North Dakota State University, Fargo, N.D. 225p.

Wenner, L.N. 1981. Social and Economic Assessment of Oil and Gas Activities: Information and Guidelines. USDA Forest Service Northern Region. R1 81-01 84p.

Employment related to production would occur in the regional area. Field maintenance crew and support personnel would be needed: repairmen, truckers, pumpers, and custodial personnel. Employment effects would be expected primarily in Teton, Glacier and Cascade Counties. The number of annual direct workers could be between 6 and 10 depending on the field size with another 9 to 15 annual indirect workers. This activity would benefit the existing oil and gas service and retail trade sectors (see Table 4.28).

Population

Choteau would experience moderate short-term impacts as a result of population growth associated with temporary nonlocal workers. This would occur during field development and would be for short periods when drilling occurs. At the peak development period the population of Choteau could increase by between 3 and 6 percent for a 30 to 90-day period. The communities of Dupuyer and Bynum could also experience some short-term changes with immigration of temporary workers. Dupuyer and Bynum are close to the Blackleaf EIS area (10 to 20 miles) but lack the services, housing and infrastructure that are available in Choteau. After the drilling activity, population changes would decrease steadily until a stable regional operational work force would be in place for production.

Production related population increases would be spread out over a larger area and would be minor. This would occur primarily in Cut Bank, Conrad, Shelby and Great Falls, where most of the oil and gas service related businesses are located.

Personal Earnings

The communities where the workers and their families reside would experience some increases in economic activity as a result of employees payroll expenditure and through company expenditures for goods and services. For the regional area, this would be less than a 1-percent increase in earnings during peak development. The impact on regional personal earnings for the period 1990 to 2000, are shown in Table 4.29.

Housing

The single most significant impact expected involves the temporary demand for housing during the drilling time frames. This housing impact would occur primarily in Choteau, where it is expected most temporary nonlocal workers would reside, and would be short-term, 30 to 120 days each year. Generally, these workers would not be accompanied by their families.

To a large extent, the nonlocal's choice of housing reflects the short duration of certain petroleum related activities, such as well drilling. Oil field personnel generally prefer apartments, motels, mobile homes, or recreational vehicles. Most of these workers seek lodging as close to the work site as possible or within the current boundaries of, or adjacent to, incorporated towns. This reflects the service, trade, housing supply, and governmental infrastructure presently available. If these workers are accompanied by their families, the demand for mobile homes and/or apartments may increase. Table 4.30 summarizes the housing impacts for Alternative 2.

TABLE 4.29

PROJECTED INCREASE IN ANNUAL REGIONAL EARNINGS (1986 dollars)[1] ALTERNATIVE 2

Year	Development Earnings	Production Earnings	Total
1990	916,000	183,200	1,099,200
1991	479,900	229,000	708,900
1992	438,500	229,000	667,500
1993	625,300	229,000	854,300
1994	758,400	229,000	987,400
1995	519,200	259,600	778,800
1996	242,200	259,600	501,800
1997	127,000	274,800	401,800
1998	136,500	274,800	411,300
1999	0	274,800	274,800
2000	0	274,800	274,800

Note: The regional area is defined as Cascade, Glacier, Lewis and Clark, Pondera, and Teton counties.

[1]BLM, 1989.

Chase, R.A., et al. 1982. Expansion and Adaptation of the North Dakota Economic-Demographic Assessment Model (NEDAM) for Montana. Technical Description: Agricultural Economics Miscellaneous Report No. 61. North Dakota Agricultural Experiment Station, North Dakota State University, Fargo, ND. 225 p.

Public Finance

The principle long-term fiscal impact to the economy from natural gas production would be public revenues. Production taxes on natural gas would benefit Teton County and the state. Table 4.31 shows estimates of the natural gas produced from the Blackleaf EIS area and an estimate of the associated royalties and taxes from 1990 to 2000.

Social Conditions

This alternative would result in a number of short-term and long-term changes in population, employment, personal earnings, and housing in the regional area of influence. While there may be individual, personal benefits associated with these changes, there is also the potential for adverse social effects; however, these impacts are anticipated to be insignificant.

The population analysis indicates that even during periods of peak employment, there would be no major demographic changes in the area. The area would not experience significant changes in such indicators of social well being as crime rates, per capita income or education levels. With no significant long-term population increases, there would be no community service impacts (e.g., water, sewage, schools) or any impacts from traffic or law enforcement problems.

In terms of ability to deal with potential social problems, an important community resource is the prior experience with oil and gas exploration and development. The area has had experience with exploration and development in the Blackleaf EIS area as discussed in Alternative 1.

TABLE 4.30

PROJECTED TEMPORARY INCREASE IN HOUSING DEMAND FOR THE COMMUNITY OF CHOTEAU DURING DEVELOPMENT AND EXPLORATION (assuming workers would not be accompanied by their families)[1]

Year	Apartment	Mobile Home	Other	Total
1990	12	12	26	50
1991	6	6	13	25
1992	12	12	26	50
1993	12	12	26	50
1994	18	18	39	75
1995	12	12	26	50
1996	6	6	13	25
1997	6	6	13	25
1998	6	6	13	25
1999	0	0	0	0
2000	0	0	0	0

[1]BLM, 1989.

Chase, R.A., et al. 1983. Profile of North Dakota's Petroleum Work Force, 1981-82. Agricultural Economics Report no. 174. North Dakota Agricultural Experiment Station, North Dakota State University, Fargo, N.D.

Alternative 3

Employment

Oil and gas development within the Blackleaf EIS area would provide short and long-term employment opportunities in the construction and transportation sectors. Employment opportunities could occur as early as 1990, when 108 jobs could be associated with constructing a gas processing facility and bringing two shut-in wells on line. Other employment opportunities would occur in the early 1990s during drilling activity. This employment would occur for relatively short time periods during drilling operations. Table 4.32 shows the employment associated with this alternative.

Peak drilling activity would be expected to occur in 1991, when approximately 75 full time jobs would be located at three drilling sites for 30 to 90 day time periods. These workers would include the drill rig crew, mud loggers and tool pushers. Local annual expenditures for goods and services would peak in 1990 and 1991, amounting to $1,074,000 and $1,033,000, respectively, for gas plant, drilling, and road/pipeline construction. Local expenditures would depend upon the availability of oil and gas support services in the area and actual surface and subsurface conditions encountered at the time a well is drilled. These expenditures could support 70 short-term jobs, directly associated with construction and other jobs supported by local expenditures. Increases in employment opportunities would cause immigration of workers for the drill rig crew, tool pushers and mud loggers while jobs in construction, transportation and oil/gas services would benefit the existing service sectors in the regional area.

TABLE 4.31

ESTIMATE OF NATURAL GAS PRODUCED FROM THE BLACKLEAF EIS AREA THE ASSOCIATED ROYALTIES AND STATE TAXES (valued at $1.42/MCF)[1] 1990-2000 ALTERNATIVE 2

Year	Production MCF	Gross Value ($1.42/MCF)	Federal Mineral Receipts[2]	State Mineral Receipts[3]	Natural Gas Production Taxes[4]
1990	3,205,500	4,551,800	440,400	25,900	398,000
1991	3,589,100	5,096,500	485,200	30,600	549,400
1992	5,828,500	8,276,500	873,400	32,400	1,070,700
1993	7,800,000	10,935,400	1,221,900	29,200	1,273,700
1994	7,570,600	10,750,300	1,213,400	26,300	1,376,300
1995	7,763,700	11,024,500	1,260,800	23,700	1,523,500
1996	6,987,400	9,922,100	1,134,800	21,300	1,452,200
1997	6,288,600	8,929,900	1,021,400	19,200	1,307,000
1998	5,659,800	8,036,900	919,300	17,300	1,176,300
1999	5,096,800	7,237,400	828,000	15,500	1,059,300
2000	4,699,300	6,673,000	762,400	14,500	977,200

Note: This information is based on probable production from producing wells. The actual could vary significantly from that shown.

[1]BLM, 1989.

[2]Assumes a federal royalty rate of 12.5 percent plus lease payments.

[3]Based on the states participation in the Blackleaf unit and assumes a state royalty rate of 12.5 percent plus lease payments.

[4]This includes the resource indemnity trust tax, gas producers privilege and license tax, natural gas severance tax and net proceeds tax.

Peak pipeline activity would be expected in 1992, when approximately 59 construction jobs could be expected for approximately 120 days. These jobs would be filled primarily by local employees who would not relocate to obtain these jobs. There would be approximately $616,000 in local expenditures from construction in 1992.

Jobs in construction, transportation and oil/gas services would occur in Teton, Glacier and Cascade Counties. In terms of increased numbers employed and the settlement pattern of nonlocal temporary workers, employment impacts related to field development would occur primarily in Choteau, in Teton County. The greatest impact to Choteau would occur during the peak drilling activity when 75 workers, associated with on site drilling, would be within the immediate area and another 6 short-term workers in support services would be needed in Choteau. Other communities in the area could also experience some short-term changes with immigration of temporary workers and increased employment opportunities. Temporary construction crews may not generate much local secondary employment; there are limits to how rapidly facilities and services could expand or would expand to accommodate temporary employees.

Production related employment would occur in the regional area. Field maintenance crew and support personnel would be needed: repairmen, truckers, pumpers, and custodial personnel. Employment impacts would be expected primarily in Teton, Glacier and Cascade Counties. The number of annual direct workers at this stage of activity could be between 5 and 8 depending on the field size with another 7 to 11 annual indirect workers. This activity would benefit the existing oil and gas service and retail trade sectors. Table 4.32 shows employment opportunities from production in the regional area of influence.

Population

Development of oil and gas would result in minor short-term impacts to Choteau; the result of population growth associated with temporary nonlocal workers. This would occur for short periods during each year when drilling occurs. At the peak development period the population of Choteau could increase by 3 percent for a 30 to 90 day period. The communities of Dupuyer and Bynum could also experience some short-term changes with immigration of temporary workers. Dupuyer and Bynum are close to the

TABLE 4.32

ESTIMATED PROJECT RELATED EMPLOYMENT OPPORTUNITIES[2]
ALTERNATIVE 3

	Development/Activities			Production	
Year	Number of Wells Drilled	On-site Full-Time Jobs Lasting 30-90 Days	Part-time Jobs Lasting up to 120 Days	Number of Producing Wells	Number of Direct and Indirect Jobs
1990	0	0	108[1]	4	12
1991	3	75	70	7	17
1992	0	0	59	7	17
1993	0	0	0	7	17
1994	1	25	21	8	18
1995	0	0	0	8	18
1996	0	0	1	8	18
1997	1	25	20	9	19
1998	0	0	0	9	19
1999	0	0	0	9	19
2000	0	0	0	9	19

[1]Employment associated with construction of the gas processing facility and bringing the two shut-in wells on line.

[2]BLM, 1989.

Chase, R.A., et al. 1982. Expansion and Adaptation of the North Dakota Economic-Demographic Assessment Model (NEDAM) for Montana. Technical Description: Agricultural Economics Miscellaneous Report no. 61. North Dakota Agricultural Experiment Station, North Dakota State University, Fargo, ND. 225p.

Wenner, L.N. 1981. Social and Economic Assessment of Oil and Gas Activities: Information and Guidelines. USDA Forest Service Northern Region. R1 81-01 84p.

Blackleaf EIS area (10 to 20 miles) but lack the services, housing and infrastructure that are available in Choteau. After the drilling activity, the development and exploration related population changes would decrease steadily until a stable regional operational work force would be in place for production.

Production related population increases would be spread over a larger area and would be minor. This would occur primarily in Cut Bank, Conrad, Shelby and Great Falls where most of the oil and gas service related businesses are located.

Personal Earnings

The communities where the workers and their families reside would experience some increases in economic activity as a result of employees payroll expenditure and through company expenditures for goods and services. For the regional area this would be less than a 1-percent increase in earnings during peak development. The impact on regional personal earnings for the period 1990 to 2000, are shown in Table 4.33.

TABLE 4.33

PROJECTED INCREASE IN ANNUAL REGIONAL EARNINGS (1986 dollars)[1] ALTERNATIVE 3

Year	Development Earnings	Production Earnings	Total
1990	636,600	183,200	819,800
1991	905,400	259,600	1,165,000
1992	365,100	259,600	624,700
1993	0	259,600	259,600
1994	71,800	274,800	346,600
1995	0	274,800	274,800
1996	3,300	274,800	278,100
1997	0	290,100	290,100
1998	0	290,100	290,100
1999	0	290,100	290,100
2000	0	290,100	290,100

Note: The regional area is defined as Cascade, Glacier, Lewis and Clark, Pondera, and Teton Counties.

[1]BLM, 1989.

Chase, R.A., et al. 1982. Expansion and Adaptation of the North Dakota Economic-Demographic Assessment Model (NEDAM) for Montana. Technical Description: Agricultural Economics Miscellaneous Report no. 61. North Dakota Agricultural Experiment Station, North Dakota State University, Fargo, ND. 225p.

TABLE 4.34

PROJECTED TEMPORARY INCREASE IN HOUSING DEMAND FOR THE COMMUNITY OF CHOTEAU DURING DEVELOPMENT AND EXPLORATION (assuming workers would not be accompanied by their families)[1] ALTERNATIVE 3

Year	Apartment	Mobile Home	Other	Total
1990	0	0	0	0
1991	18	18	39	75
1992	0	0	0	0
1993	0	0	0	0
1994	6	6	13	25
1995	0	0	0	0
1996	0	0	0	0
1997	6	6	13	25
1998	0	0	0	0
1999	0	0	0	0
2000	0	0	0	0

[1]BLM, 1989.

Chase, R.A., et al. 1983. Profile of North Dakota's Petroleum Work Force, 1981-82. Agricultural Economics Report no. 174. North Dakota Agricultural Experiment Station, North Dakota State University, Fargo, N.D.

Housing

Field development may cause a demand for temporary housing. This housing impact would be minor, occur primarily in Choteau, where it is expected most temporary nonlocal workers would reside and would be short-term, 30 to 120 days each year.

To a large extent, the nonlocal's choice of housing reflects the short duration of certain petroleum related activities, namely well drilling. Oil field personnel generally prefer apartments, motels, mobile homes, or recreational vehicles. Most of these workers seek lodging as close to the work site as possible or within the current boundaries of, or adjacent to, incorporated towns. This reflects the service, trade, housing supply, and governmental infrastructure presently available. If these workers are accompanied by their families, the demand for mobile homes and/or apartments may increase. Table 4.34 summarizes the housing impacts for Alternative 3.

Public Finance

The principle long-term fiscal impact to the economy from natural gas production would be public revenues. Production taxes on natural gas would benefit Teton County and the state. Table 4.35 shows estimates of natural gas produced from the Blackleaf EIS area and the associated royalties and taxes from 1990 to 2000.

TABLE 4.35

ESTIMATE OF NATURAL GAS PRODUCED FROM THE BLACKLEAF EIS AREA THE ASSOCIATED ROYALTIES AND STATE TAXES (valued at $1.42/MCF)[1]
1990-2000
ALTERNATIVE 3

Year	Production MCF	Gross Value ($1.42/MCF)	Federal Mineral Receipts[2]	State Mineral Receipts[3]	Natural Gas Production Taxes[4]
1990	1,611,200	2,287,900	194,700	18,500	247,100
1991	4,315,900	6,128,600	625,900	28,200	607,300
1992	3,884,300	5,515,700	563,400	25,400	757,800
1993	3,495,900	4,964,100	507,100	22,900	682,000
1994	3,146,300	4,467,700	456,500	20,600	613,900
1995	2,831,700	4,021,000	410,900	18,600	554,700
1996	2,548,500	3,618,900	369,900	16,700	517,200
1997	2,293,600	3,257,000	333,000	15,000	465,500
1998	2,064,300	2,931,300	299,700	13,500	418,900
1999	1,797,900	2,552,900	263,000	11,400	364,200
2000	1,672,100	2,374,300	242,900	11,000	339,300

Note: This information is based on probable production from producing wells. The actual could vary significantly from that shown.

[1]BLM, 1989.
[2]Assumes a federal royalty rate of 12.5 percent plus lease payments.
[3]Based on the states participation in the Blackleaf unit and assumes a state royalty rate of 12.5 percent plus lease payments.
[4]This includes the resource indemnity trust tax, gas producers privilege and license tax, natural gas severance tax and net proceeds tax.

Social Conditions

This alternative would result in a number of short-term and long-term changes in population, employment, personal earnings, and housing in the regional area of influence. While there may be individual, personal benefits associated with these changes, there is also the potential for adverse social effects, but these impacts would be insignificant.

The population analysis indicates that even during periods of peak employment, there would be no major demographic changes in the area. The area would not experience significant changes in such indicators of social well being as crime rates, per capita income or education levels. With no significant long-term population increases, there would be no community service impacts (e.g., water, sewage, schools) or any impacts from traffic or law enforcement problems.

In terms of ability to deal with potential social problems, an important community resource is the prior experience with oil and gas exploration and development. The area has had experience with exploration and development in the Blackleaf EIS area as discussed in Alternative 1.

Alternative 4

Employment

Oil and gas development within the Blackleaf EIS area would provide short and long-term employment opportunities in the construction and transportation sectors. Employment opportunities could occur as early as 1990, when 114 jobs could be associated with constructing a gas processing facility, bringing two shut-in wells on line and drilling one well. Other employment opportunities could occur throughout the 1990s during drilling activity. This employment would occur for relatively short time periods each year during drilling operations. Table 4.36 shows the employment associated with this alternative.

Peak drilling activity would be expected to occur in 1991, when approximately 75 full time jobs would be located at three drilling sites for 30 to 90 day time periods. These workers would include the drill rig crew, mud loggers and tool pushers. Local annual expenditures for goods and services during this phase could amount to $1,228,000 for drilling and road/pipeline construction. Local expenditures would depend upon the availability of oil and gas support services in the area and actual surface and subsurface conditions encountered at the time a well is drilled. These expenditures could support 98 short-term jobs. This would include those jobs directly associated with construction and other jobs supported by local expenditures. Increases in employment opportunities would cause immigration of workers for the drill rig crew, tool pushers and mud loggers while jobs in construction, transportation and oil/gas services would benefit the existing service sectors in the regional area.

Peak road and pipeline activity would be expected in 1994, when approximately 98 construction jobs could be expected for approximately 120 days. These jobs would be filled primarily by local employees who would not relocate to obtain these jobs. There would be approximately $1,452,000 in local expenditures from construction and drilling at two well sites in 1994.

TABLE 4.36

ESTIMATED PROJECT-RELATED EMPLOYMENT OPPORTUNITIES[2]
ALTERNATIVE 4

	Development/Activities			Production	
Year	Number of Wells Drilled	On-site Full-Time Jobs Lasting 30-90 Days	Part-time Jobs Lasting up to 120 Days	Number of Producing Wells	Number of Direct and Indirect Jobs
1990	0	0	114[1]	12	4
1991	3	75	98	7	17
1992	0	0	86	7	17
1993	2	50	74	9	19
1994	2	50	119	11	22
1995	1	25	90	12	23
1996	2	50	67	14	26
1997	1	25	22	15	28
1998	1	25	20	16	29
1999	1	25	19	17	31
2000	0	0	0	17	31

[1]Employment associated with construction of the gas processing facility and bringing the two shut-in wells on line.

[2]BLM, 1989.

Chase, R.A., et al. 1982. Expansion and Adaptation of the North Dakota Economic-Demographic Assessment Model (NEDAM) for Montana. Technical Description: Agricultural Economics Miscellaneous Report no. 61. North Dakota Agricultural Experiment Station, North Dakota State University, Fargo, N.D. 225p.

Wenner, L.N. 1981. Social and Economic Assessment of Oil and Gas Activities: Information and Guidelines. USDA Forest Service Northern Region. R1 81-01 84p.

Jobs in construction, transportation and oil/gas services would be expected in Teton, Glacier and Cascade Counties. In terms of increased numbers employed and the settlement pattern of nonlocal temporary workers, employment impacts related to development and exploration would occur primarily in Choteau, in Teton County. The greatest impact to Choteau would occur during the peak drilling activity when 75 temporary workers, associated with on site drilling, would be within the immediate area and another 11 short-term workers in support services would be needed in Choteau. Other communities in the area could also experience some short-term changes with inmigration of temporary workers and increased employment opportunities. Temporary construction crews may not generate much local secondary employment; there are limits to how rapidly facilities and services could expand or will expand to accommodate temporary employees.

Production related employment would occur in the regional area. Field maintenance crew and support personnel are needed: repairmen, truckers, pumpers, and custodial personnel. Employment effects are expected to occur primarily in Teton, Glacier and Cascade Counties. The number of annual direct workers at this stage of activity could be between 6 or 10 depending on the field size with another 8 to 15 annual indirect workers. This activity would benefit the existing oil and gas service and retail trade sectors (see Table 4.36).

Population

Development of oil and gas would result in minor short-term impacts to the community of Choteau; the result of population growth associated with temporary nonlocal workers. This would occur for short periods while drilling occurs. At the peak development period the population of Choteau could increase by 4 percent for a 30 to 90-day period. The communities of Dupuyer and Bynum could also experience some short-term changes with immigration of temporary workers. Dupuyer and Bynum are close to the Blackleaf EIS area (10 to 20 miles) but lack the services, housing and infrastructure that are available in Choteau. After the drilling activity, population changes would decrease steadily until a stable regional operational work force would be in place for production.

Production related population increases would be spread out over a larger area and would be minor. This would occur primarily in Cut Bank, Conrad, Shelby and Great Falls where most of the oil and gas service related businesses are located.

Personal Earnings

The communities where the workers and their families reside would experience some increases in economic activity as a result of employees payroll expenditure and through company expenditures for goods and services. For the regional area this would be less than a 1-percent increase in earnings during peak development. The impact on regional personal earnings for the period 1990 to 2000 are shown in Table 4.37.

TABLE 4.37

PROJECTED INCREASE IN ANNUAL REGIONAL EARNINGS (1986 dollars)[1] ALTERNATIVE 4

Year	Development Earnings	Production Earnings	Total
1990	657,000	183,200	840,200
1991	1,062,000	229,000	1,291,000
1992	528,000	259,600	787,600
1993	562,200	290,100	852,300
1994	872,900	305,400	1,178,300
1995	580,700	335,900	916,600
1996	556,500	335,900	892,400
1997	203,800	335,900	539,700
1998	194,900	335,900	530,800
1999	187,600	335,900	523,500
2000	0	335,900	335,900

Note: The regional area is defined as Cascade, Glacier, Lewis and Clark, Pondera, and Teton Counties.

[1]BLM, 1989.

Chase, R.A., et al. 1982. Expansion and Adaptation of the North Dakota Economic-Demographic Assessment Model (NEDAM) for Montana. Technical Description: Agricultural Economics Miscellaneous Report No. 61. North Dakota Agricultural Experiment Station, North Dakota State University, Fargo, ND. 225p.

Housing

Field development may cause a demand for temporary housing. This housing impact would be moderate and occur primarily in Choteau, where most temporary, non-local workers would reside and would be short-term, 30 to 120 days each year. Table 4.38 summarizes the housing impacts for Alternative 4.

To a large extent, the nonlocal's choice of housing reflects the short duration of certain petroleum related activities, namely well drilling. Oil field personnel generally prefer apartments, motels, mobile homes, or recreational vehicles. Most of these workers seek lodging as close to the work site as possible or within the current boundaries of, or adjacent to, incorporated towns. This reflects the service, trade, housing supply, and governmental infrastructure presently available. If these workers are accompanied by their families, the demand for mobile homes and/or apartments may increase.

TABLE 4.38

PROJECTED TEMPORARY INCREASE IN HOUSING DEMAND FOR THE COMMUNITY OF CHOTEAU DURING DEVELOPMENT AND EXPLORATION (assuming workers would not be accompanied by their families)[1]

Year	Apartment	Mobile Home	Other	Total
1990	0	0	0	0
1991	18	18	39	75
1992	0	0	0	0
1993	12	12	26	50
1994	12	12	26	50
1995	6	6	13	25
1996	12	12	26	50
1997	6	6	13	25
1998	6	6	13	25
1999	6	6	13	25
2000	0	0	0	0

[1]BLM, 1989.

Chase, R.A., et al. 1983. Profile of North Dakota's Petroleum Work Force, 1981-82. Agricultural Economics Report no. 174. North Dakota Agricultural Experiment Station, North Dakota State University, Fargo, N.D.

Public Finance

The principle long-term fiscal affect to the economy from natural gas production would be public revenues. Production taxes on natural gas would benefit Teton County and the state. Table 4.39 shows estimates of natural gas produced from the EIS area and the associated royalties and taxes from 1990 to 2000.

Social Conditions

This alternative would result in a number of short-term and long-term changes in population, employment, personal earnings, and housing in the regional area of influence. While there may be individual, personal benefits associated with these changes, there is also the potential for adverse social effects, which should not be significant.

The population analysis indicates that even during periods of peak employment, this alternative would not create major demographic changes in the area. The area would not experience significant changes in such indicators of social well being as crime rates, per capita income or education levels. With no significant long-term population increases, there would be no community service impacts (e.g., water, sewage, schools) or any impacts from traffic or law enforcement problems.

In terms of ability to deal with potential social problems, an important community resource is the prior experience with oil and gas exploration and development. The area has had experience with exploration and development in the Blackleaf EIS area as discussed in Alternative 1.

TABLE 4.39

ESTIMATE OF NATURAL GAS PRODUCED FROM THE BLACKLEAF EIS AREA
THE ASSOCIATED ROYALTIES AND STATE TAXES (valued at $1.42/MCF)[1]
1990-2000
ALTERNATIVE 4

Year	Production MCF	Gross Value ($1.42/MCF)	Federal Mineral Receipts[2]	State Mineral Receipts[3]	Natural Gas Production Taxes[4]
1990	1,446,400	2,053,900	176,900	16,100	229,100
1991	4,510,900	6,405,500	660,000	31,900	619,500
1992	4,423,500	6,281,300	658,600	28,700	854,300
1993	4,872,400	6,918,900	751,100	25,800	893,200
1994	4,752,100	6,748,000	741,200	23,300	916,200
1995	4,728,800	6,714,900	747,300	20,900	907,500
1996	4,255,900	6,043,400	672,700	18,800	881,600
1997	3,830,300	5,439,000	605,500	17,000	793,500
1998	3,447,300	4,895,100	545,000	15,300	714,100
1999	3,032,100	4,305,600	482,700	12,800	627,700
2000	2,792,300	3,965,100	441,600	12,400	578,400

Note: This information is based on probable production from producing wells. The actual could vary significantly from that shown.

[1]BLM, 1989.
[3]Assumes a federal royalty rate of 12.5 percent plus lease payments.
[3]Based on the states participation in the Blackleaf unit and assumes a state royalty rate of 12.5 percent plus lease payments.
[4]This includes the resource indemnity trust tax, gas producers privilege and license tax, natural gas severance tax and net proceeds tax.

MITIGATION

The standard management practices referenced in Chapter 2 and outlined in Appendix B are requirements with which the Blackleaf Unit Operator and/or lessees will have to comply. These standard management practices are applicable to all alternatives and would be enforced no matter which alternative was selected as the agencies preferred alternative.

The mitigation measures outlined below are also requirements with which the Blackleaf Unit Operator and/or lessees will have to comply. Any or all of these requirements, plus any others deemed necessary at the onsite inspection, will be included in the applicants APDs to lessen the site specific impacts for each wellsite. The BLM and FS have committed to these measures and are responsible for their enforcement.

Cultural Resources

C-1 In areas of high potential for cultural resources, the BLM will distribute Archeological Resources Protection Act (ARPA) information to help discourage collection of cultural resources.

C-2 Pipelines, where possible, will be buried adjacent to wellsite access roads.

Soil Resources

S-1 Where possible, avoid placing cut/fill slopes in soil type 14D (see Appendix I). If avoidance isn't possible, cut/fill slopes will be kept under 10 feet in height.

Wildlife Resources

W-1 Surface disturbing activities will not be allowed within 1-mile of mountain goat mineral licks.

W-2 Avoid construction of wells, pipelines and/or roads within 1-mile of occupied mountain goat yearlong habitat.

W-3 Avoid well drilling and pipeline construction within 1-mile of bighorn sheep winter ranges and rutting, lambing and mineral lick areas.

W-4 Provide a 1-mile zone of no activity to separate each disturbance activity from an occupied bighorn sheep seasonal use area.

W-5 No oil and gas disturbance will occur simultaneously in adjacent drainages within seasonally important elk habitat.

W-6 The use of roads/trails which cross or come within 1/2-mile of a mountain goat mineral lick will be restricted to non-motorized use between May 1 and July 31.

W-7 Insert doglegs or visual barriers on pipelines and roads built through dense vegetative cover areas to prevent straight corridors exceeding 1/4-mile where vegetation has been removed.

W-8 Where possible, power lines will be buried to eliminate the possibility of raptor injury and/or mortality. Install markers on wires heavily used by raptors to reduce collisions with wires.

W-9 One central gas processing facility may be required to remotely monitor wellheads and reduce the amount of vehicle traffic in the EIS area. Production facilities would be located off site at this central processing facility; any change in this policy will require approval by the AO after further consultation with the USFWS.

W-10 The first year of production or at least through the first winter, wellsites could be visited a maximum of once per day, unless problems arise or maintenance is necessary. After all problems are resolved and well producing becomes "routine", wellsite visits will drop to once every three days.

Surface Water

SW-1 Facilities constructed in soil type 161 (see Appendix I) will require careful draining and the use of slash filter strips to trap sediment and reduce erosion.

Visual Resources

VR-1 Production stock tanks will not exceed 12 feet in height.

VR-2 Right-of-way clearing in timbered, dense shrub, and scenic areas shall be limited to a minimum width necessary to prevent interference of trees and other vegetation with the facility construction. Authorized Officer may require clearing to be "feathered or graded" with curved or undulating boundaries to lessen visual "tunnel" effect. In locations where the right-of-way enters timber, including dense shrub, from meadows or other open areas, the Authorized Officer may require clearing to be "feathered" into the timber in order to retain maximum natural vegetative patterns. Authorized Officer may require a landscape architect to assist in the design of the pipeline route.

VR-3 Where necessary, road cuts will require broken-face blasting, and then coloring the rock face with a petroleum emulsion tactifier mulch.

VR-4 Where necessary, soil cuts/fills will require a petroleum emulsion mulch or organic material mulch with low color contrast to reduce visual impacts.

VR-5 Well pads will be bermed and seeded to reduce visual contrast.

VR-6 Flare stacks will be hinged to be let down when not in use.

RECOMMENDED MITIGATION

This section (Table 4.40) lists recommended mitigation measures, by alternative, that would lessen the effects on the various resources that would result from the proposed drilling and production operations. Many of these mitigation measures are very general in nature; however, site specific mitigation will be imposed when APDs are submitted.

TABLE 4.40
IMPACTS AND MITIGATION BY ALTERNATIVE

	ALTERNATIVE 1		ALTERNATIVE 2	
Resource	**Impact**	**Mitigation**	**Impact**	**Mitigation**
Air Quality	No impacts from the central gas plant because it is a "closed system" process.	Standard Management Practice	Short-term minor impacts during drilling operations. Increased moderate impacts from production facilities at each wellsite, due to increased wellhead and production facilities.	Require vapor recovery units. Limit flaring/venting.
Geology	No impacts.	None.	Drilling would increase subsurface geologic information.	None.
Oil and Gas	An estimated 96.3 and 257.0 BCF of natural gas would not be produced. No additional geologic or reservoir information would be gained. 23 of 25 leases would not be produced.	Standard Management Practice Lease stipulations (Appendix C).	Positive impact to companies due to maximum drilling and production. An estimated 92.2 to 178.4 BCF of natural gas would be produced. 6,400 high potential acres, 2,560 medium potential acres and 640 low potential acres would be developed. 12 of 25 leases would not be produced.	Standard Management Practice Lease Stipulations (Appendix C).
Paleontology	Pipeline construction may disturb the context in which fossils are found. Overall effect may be positive because of possible new discoveries and new knowledge. Minor negative impact by loss of fossils to collectors.	Standard Management Practice	Same as Alternative 1, but on larger scale, because of the increased number of wellsites.	Standard Management Practice
Cultural Resources	Low potential for impact as all actions proposed for areas previously disturbed.	Standard Management Practice	199 acres disturbed by construction activities. Increased access/human activity may increase illegal collection of artifacts.	Standard Management Practice
Soils	Impact to 25 acres of soil types with low soil stability hazards. Impact to approximately 9 acres having moderate soil stability.	Standard Management Practice	Approximately 61 acres of soil having low soil stability hazards would be affected. Approximately 128 acres of soil having moderate soil stability hazards would be affected.	Standard Management Practice

TABLE 4.40 (continued)
IMPACTS AND MITIGATION BY ALTERNATIVE

Resource	ALTERNATIVE 1 Impact	ALTERNATIVE 1 Mitigation	ALTERNATIVE 2 Impact	ALTERNATIVE 2 Mitigation
Vegetation	Approximately 24 acres of forested area would be disturbed. 9 acres of grassland would be disturbed reducing forage potential by 4,600 lbs. forage/year. These 34 acres would be susceptible to noxious weed infestation.	Standard Management Practice	Approximately 140 acres of forested area, would be disturbed. 36 acres of grassland vegetation would be disturbed, reducing forage potential by 18,500 lbs. forage/year. 4.8 acres gravel bar impacted. 182 acres of disturbance susceptible to noxious weed infestation.	Standard Management Practice
Livestock	20 acres forage disturbed resulting in 2.4 AUMs lost.	Standard Management Practice	118.4 acres of forage disturbed, resulting in 14.8 AUMs lost.	Standard Management Practice
Visual	Positive impact from dismantling 1-8, 1-5 facilities, improving visual quality in foreground and middle grounds. Minor, short-term visual contrast from pipeline construction.	Standard Management Practice	Significant impacts from constructing roads to E-2, S-2, S-5 wellsites. Moderate impacts from E-3, S-6, S-7 wellsites and roads. Foreground view moderately impacted because of facilities at each wellsite.	Exposed or disturbed soil should not be visible. Color rock faces to blend with surroundings. Minimize cuts and fills. Standard Management Practice
Fish and Wildlife				
*Wildlife				
Grizzly Bear	Spring habitat — 12,060 acres.		Spring habitat — 38,020 acres; denning habitat — 170 acres.	Same as Alternative 1.
Rocky Mountain Goat	Occupied yearlong — 2,050 acres; breeding, kidding, nursery — 2,050 acres; goat year long habitat.	Avoid construction of wellsites pipelines or roads within 1 mile of occupied mountain goat year long habitat.	Occupied yearlong — 8,390 acres; breeding, kidding, nursery — 8,390 acres; mineral licks — *(5)	Not allowing surface disturbing activities within 1 mile of mountain goat mineral licks.
Bighorn Sheep			Winter range — 530 acres.	Avoid well drilling or pipeline construction with 1 mile of bighorn sheep winter ranges and rutting, lambing and mineral lick area. Provide 1-mile zone of no activity to separate each disturbance activity from an occupied bighorn sheep seasonal use area.

TABLE 4.40 (continued)

IMPACTS AND MITIGATION BY ALTERNATIVE

	ALTERNATIVE 1		ALTERNATIVE 2	
Resource	Impact	Mitigation	Impact	Mitigation
Elk	Winter range — 12,060 acres; calving area — 920 acres; migration routes — *(2).	Do not allow increased levels of disturbance caused by human activities to occur simultaneously in adjacent drainages within seasonally important elk habitat.	Winter range — 33,810 acres; calving area — 5,180 acres; migration routes — *(4).	
Mule Deer	Winter range — 5,410 acres; fall transitional range — 400 acres; migration routes — *(2).	Insert doglegs or visual barriers on pipelines and roads built through dense vegetation cover areas to prevent straight corridors exceeding 1/4 mile where vegetation has been removed.	Winter range — 15,600 acres; fall transitional range — 2,980 acres; migration routes — *(3).	
Raptors	Breeding/nesting habitats — *(16).	Use fall timing window to lessen impacts to most species (exact dates based on site specifics of activities).	Breeding/nesting habitats — *(78).	
Fisheries	*(2).		*(9).	

*Each number represents one wellsite falling within a 1-mile zone of influence of the habitat feature.

Surface Water	Short term minor increase in sedimentation due to pipeline construction.	Standard Management Practices	Moderate increased erosion and sedimentation in floodplains and wetlands.	Standard Management Practice Use slash filter strips to trap sediment near drainage.
Groundwater	Increased turbidity and sedimentation of short-term minor impact. Minor impacts due to lowering of intercepted groundwater in pipeline trenches. No lasting effects.	None.	Minor impact during road and drill pad construction due to increased sedimentation. No lasting effect. Minimal possibility that drilling fluids would entersubsurface aquifers. Minimal possibility of impacts from subsurface disposal of produced water. Geologic record is that very little salt water is expected. Temporary increase in turbidity and sediment would be a minor impact. Less infiltration and increased run-off due to compaction. Minimal possibility of impacts from subsurface disposal of produced water.	Standard Management Practice

TABLE 4.40 (continued)

IMPACTS AND MITIGATION BY ALTERNATIVE

	ALTERNATIVE 1		ALTERNATIVE 2	
Resource	Impact	Mitigation	Impact	Mitigation
Recreation	Short-term increase in noise and additional traffic from pipeline and gas plant construction. Minor short-term impact to outdoor recreational experience. Short-term limitation of access to USFS Trail 106 and adjacent facilities.	Complete construction prior to or after hunting seasons.	Reduction of 80 acres from semiprimitive setting to a roaded natural setting. Existing travel ways could be more accessible and create access to areas that were previously inaccessible. USFS trails 106, 124, 153 would be easier to access, possibly lessening the overall recreational experience. 5.9 miles of new road would be constructed along eastern border of Teton Roadless Area.	Standard Management Practice
Noise	Short-term increase during construction activities.	None.	Short term impacts during drilling and construction. Minor long term impacts from production noise at the wellsite and vehicle traffic to and from the wellsite by maintenance workers, tanker trucks hauling condensate, etc. Increased noise may impact wildlife.	Standard Management Practice
Transportation System	No impacts.	None.	Possibilities of increased public vehicle use of road system, causing washboarding, rutting, etc.	Standard Management Practice
Economics	Negative impacts to oil and and gas industry and federal and state leasing revenue. Industry would be able to develop 2 of 25 leases. $17,000-$44,000 annual leasing revenue on undeveloped reserves not available to federal government. $8,500-$22,000 annual leasing revenue on developed reserves not available to State of Montana.	None.	*Population*—moderate short-term population growth for Choteau. Minor population increases distributed across the five-county regional zone of influence. *Employment*—short-term moderate beneficial impacts due to increased number of full-time (30-90 day period) production related workers and part-time (120-day period) non-production workers. *Income*—communities would experience moderate, short-term increases in income due to increased personal earnings from economic activity.	None.

TABLE 4.40 (continued)

IMPACTS AND MITIGATION BY ALTERNATIVE

	ALTERNATIVE 1		ALTERNATIVE 2	
Resource	Impact	Mitigation	Impact	Mitigation
			Housing—significant, short-term increase in demand for housing. Existing housing inventory adequate for increases in population due to employment opportunities.	
			Facilities and Services—moderate, short-term increases in demand for community services. Existing services inventory adequate for increases in population due to employment opportunities.	
			Public Finance—beneficial impacts to Teton County and State of Montana from production taxes.	
			Social Conditions—insignificant, adverse impacts due to effects of short-term increases in population influencing life-style, and factors of social well-being.	

TABLE 4.40 (continued)

IMPACTS AND MITIGATION BY ALTERNATIVE

	ALTERNATIVE 3		ALTERNATIVE 4	
Resource	Impact	Mitigation	Impact	Mitigation
Air Quality	Minor short-term impacts during drilling. No impacts from "closed system" gas processing plant.	Same as Alternative 2.	Similar to Alternative 2.	Same as Alternative 2.
Geology	Same as Alternative 2.	None.	Same as Alternatives 2.	None.
Oil and Gas	An estimated 96.3 to 239.1 BCF of natural gas would not be produced. 21 of 25 leases would not be produced.	Standard Management Practices. Lease stipulations (Appendix C).	An estimated 95.0 to 215.8 BCF of natural gas would not be produced. 13 of 25 leases would not be produced.	Standard Management Practices. Lease stipulations (Appendix C).
Paleontology	Same as Alternative 1. The E-4 site has potential to effect dinosaur fossils classified as significant.	Standard Management Practice	Same as Alternative 2.	Standard Management Practice

TABLE 4.40 (continued)

IMPACTS AND MITIGATION BY ALTERNATIVE

Resource	ALTERNATIVE 3		ALTERNATIVE 4	
	Impact	Mitigation	Impact	Mitigation
Cultural Resources	102 acres disturbed. Other impacts same as Alternative 2.	Standard Management Practice	289 acres disturbed. Other impacts same as Alternative 2.	Standard Management Practice
Soils	Approximately 26 acres of soil characterized by moderate soil stability hazards will be affected. Approximately 30 acres have low soil stability hazards.	Standard Management Practice	Approximately 60 acres of soil characterized by low soil stability hazards would be affected. Approximately 122 acres having moderate soil stability hazards would be affected.	Standard Management Practice
Vegetation	Approximately 38 acres of forested area would be disturbed. 19 acres of grassland vegetation would be disturbed, reducing forage potential by 9,800 lbs. forage/year. These 57 acres would be susceptible to noxious weed infestation.	Standard Management Practice	Approximately 149 acres of forested area would be disturbed. 29 acres of grassland vegetation would be disturbed, reducing forage potential by 15,500 lbs. total forage/year. 6 acres gravel bar would be affected space. These 184 acres would be susceptible to noxious weed infestation.	Standard Management Practice
Livestock	28.5 acres of forage disturbed disturbed, resulting in 3.4 AUMs lost.	Standard Management Practice	96.5 acres of forage disturbed resulting in 11.9 AUMs lost.	Standard Management Practice
Visual	Impacts less than in Alternative 2, due to remote monitoring and less sites. Short-term impacts from pipelines.	Same as Alternatives 1 and 2, as applicable.	Overall moderate visual impacts with some localized areas of significant impacts. Impacts very similar to Alternative 2.	Same as Alternatives 1, 2 and 3.
Fish and Wildlife				
*Wildlife				
Grizzly Bear	Spring habitat — 20,000 acres.	Same as Alternatives 1.	Spring habitat — 38,020 acres; Denning habitat — 170 acres.	Same as Alternative 2.
Rocky Mountain Goat	Occupied yearlong — 2,050 acres; breeding, kidding, nursery — 2,160 acres.		Occupied yearlong — 7,680 acres; breeding, kidding, nursery — 7,680 acres; mineral licks - *(4).	
Bighorn Sheep			Winter range — 430 acres.	
Elk	Winter range — 17,810 acres; calving area — 1,000 acres; migration routes — *(2).		Winter range — 35,820 acres; calving area — 4,900 acres; migration routes — *(4).	

TABLE 4.40 (continued)

IMPACTS AND MITIGATION BY ALTERNATIVE

	ALTERNATIVE 3		ALTERNATIVE 4	
Resource	Impact	Mitigation	Impact	Mitigation
Mule Deer	Winter range — 13,150 acres; fall transitional range — 400 acres; migration routes — *(3).		Winter range — 17,680 acres; fall transitional range — 2,930 acres; migration routes — *(3).	
Raptors	Breeding/nesting habitats — *(29).		Breeding/nesting habitats — *(73).	
Fisheries	*(3).		*(8).	

*Each number represents one wellsite falling with a 1-mile zone of influence of the habitat feature.

Surface Water	Similar to Alternative 1.	Same as Alternative 1.	Similar to Alternative 1.	Same as Alternative 2.
Groundwater	Similar but less than Alternative 2.	Same as Alternative 2.	Similar to Alternative 2.	Same as Alternative 2.
Recreation	Same as Alternative 1.	Same as Alternative 1.	Similar to Alternative 2.	Standard Management Practice
Noise	Similar to those in Alternative 1. Insignificant noise at the wellsites due to the central gas processing plant.	Same as Alternative 1.	Same as Alternative 2.	Same as Alternative 3.
Transportation System	Impacts similar to but less than Alternative 2.	Standard Management Practice	Impacts very similar to Alternative 4.	Standard Management Practice
Economics	Impacts same as Alternative 2 for population, employment, income, housing, facilities and services, public finance and social conditions.	None.	Impacts same as Alternative 2 for population, employment, income, housing, facilities and services, public finance, and social conditions.	None.

SCOPING AND ISSUE IDENTIFICATION

At the beginning of this project the BLM and Forest Service held a series of public meetings in local communities to gather public comments regarding oil and gas development in the EIS area. Those comments expressed concern for wildlife, threatened and/or endangered species, impacts to visual resources, local economic development, tourism, recreation, impacts on local landowners, potential impacts of H_2S on human health and safety and effects to the adjacent Bob Marshall Wilderness Area.

The public scoping meetings identified additional public concerns regarding the stability of the oil and gas industry, the need for oil and gas resources, public attitudes, impacts to water resources and the cumulative effects of development.

The comments received during the scoping process were used in the development of evaluation criteria for the environmental analysis.

CONSULTATION AND COORDINATION IN PREPARATION OF THE DOCUMENT

The U.S. Fish and Wildlife Service was asked to provide any listed and proposed threatened and/or endangered species that may be present in the EIS area. Formal consultation through the USFWS's Endangered Species Office, began when BLM submitted a Biological Assessment describing the impacts of the alternatives discussed in this EIS. Section 7(d) of the Endangered Species Act requires that during the consultation process no irreversible or irretrievable commitment of resources will occur.

The Montana Department of Fish, Wildlife and Parks was contacted regarding bighorn sheep, Rocky Mountain goat, elk and deer populations and herd composition.

A scoping meeting for state government agencies that might be affected by, or have an interest in this project, was held in Helena on October 3, 1985. The following agencies were present:

Bureau of Land Management
U.S. Forest Service (Lewis & Clark)
Montana Department of State Lands
Montana Department of Fish, Wildlife and Parks
Montana State Historic Preservation Office
Montana Department of Agriculture
Montana Governor's Office
Montana Department of Commerce

The following is a list of scoping meetings held regarding this project:

Sept. 30, 1985	Lewistown District Advisory Council — Circle 8 Ranch
Oct. 2, 1985	Montana Wilderness Groups — Helena
Oct. 3, 1985	State Government — Helena Western Environmental Trade Association
Oct. 9, 1985	Public Workshop — East Glacier
Oct. 10, 1985	Public Workshop — Cutbank
Oct. 15, 1985	Local Landowners — Choteau
Oct. 16, 1985	Public Workshop — Choteau
Oct. 17, 1985	Local Interest Groups — Great Falls
Oct. 23, 1985	Public Workshop — Great Falls
Oct. 24, 1985	Montana Petroleum Association — Helena
Oct. 24, 1985	Special Interest Groups — Missoula

REVIEW

BLM requested comments from interest groups and individuals; from federal, state and local agencies; and from Native Americans. The following is a partial list of organizations and agencies that received this document.

County Commissioners, Boards of Planning and Chambers of Commerce

Cascade County Commissioners
Montana Chamber of Commerce
Teton County Commissioners

State of Montana

Department of Health and Environmental Sciences, Water Quality Bureau
Representative John Cobb
Montana Environment Quality Council
Montana Department of Fish, Wildlife, and Parks
Department of Community Affairs
Department of Health and Environmental Sciences, Air Quality Bureau
Department of Natural Resources and Conservation
Department of State Lands
Stan Stephens, Governor of Montana
Intergovernmental Review Clearinghouse

Congressional

Honorable Max Baucus
Honorable Conrad Burns
Honorable Ron Marlenee
Honorable Pat Williams

Federal Agencies

Advisory Council on Historic Preservation
Army Corps of Engineers
Tribal Business Council, Blackfeet Indian Nation
U.S. Fish and Wildlife Service
U.S. Army Corps of Engineers
U.S. Geological Survey
U.S. Forest Service, Lewis & Clark National Forest
Library and Information Service, Department of Interior
Bureau of Mines
Office of Environmental Compliance
United States Energy
Assistant Secretary of the Air Force
Pentagon, Secretary of the Army
Bureau of Indian Affairs
Bureau of Reclamation, Division of Environmental Affairs
Department of Energy, Western Area Power Administration
Department of Transportation
Federal Aviation Administration
Environmental Protection Agency
Federal Highway Administration
Federal Housing Administration
U.S. Geological Survey, Environmental Affairs Program
Minerals Management Service
National Park Service
Soil Conservation Service

Special Interest Groups

American Fisheries Society
American Horse Protection Association
American Mining Congress Journal
Billings Rod and Gun Club
Bob Marshall Ecosystem
Missoula Backcountry Horsemen
Eastern Montana College
Defenders of Wildlife
Environmental Impact Services
Fishing and Floating Outfitters Association of Montana
Great Bear Foundation
Humane Society of the U.S.
Independent Petroleum Association of Mountain States
Inland Forest Resource Council
Izaak Walton League of America
American Outdoors Project
Laurel Rod and Gun Club
Glacier Two Medicine Alliance
Lewistown Rod and Gun Club
Center for Disease Control
Sierra Club Regional Representative
Minerals Exploration Coalition
Montana Association of Grazing Districts
Montana Cattlemans Association
Montana Stockgrowers Association
Montana Wilderness Association
Montana Wildlife Federation
Montana Outfitters Association
Montana Audubon Council
Montana Automobile Association
Montana Coal Council
Montana Council of Cooperatives
Montana Environmental Information Center
Environmental Quality Council
Montana Farm Bureau
Montana Farmers Union
Montana Geological Society
Montana Historical Society
Montana Land and Minerals Owners Association
Montana Mining Association
Montana Petroleum Association
Montana Public Lands Council
State Grazing District Association
Montana State University
Montana Stockgrowers Association
Montana Wilderness Association
Montana Wildlife Federation
Montana Woolgrowers
National Audubon Society
Yellowstone Valley Audubon Society
National Wildlife Federation
Natural Resources Defense Council
NCD Ecosystem
Nevada Outdoor Recreational Association, Inc.
Northern Plains Resource Council
Overthrust Foundation
Pennsylvania Coop Wildlife Research Unit
Public Lands Council
Wilderness Institute
Montana Wildlands Coalition
Sierra Club
Colorado State University
Trout Unlimited
Department of Anthropology, University of Montana
Western Environmental Trade Association
The Wilderness Society
Wilderness Institute
Wildlife Management Institute
The Wildlife Society

Business and Organizations

Airo Drilling Corporation
Amax Exploration, Inc.
Amec, Inc.
American Colloid Company
American Petrofina Company of Texas
Amoco Production Company
Anaconda Minerals Company
Andover Resources
Arco Exploration Company
Atlantic Richfield Company
J.R. Bacon Drilling, Inc.
Balcron Oil Company
Black Bow Exploration
Blackleaf Petroleum Company
Bond Operating Company
Bronco Exploration
Burton/Hawks, Inc.
Cascade Courier
Celsius Energy Corporation
Choteau Acantha
Cities Service Oil and Gas Corporation
City Oil Company
CNG Producing
Coastal Oil and Gas Corporation
Coastal States Energy Company
Comanche Drilling Company
Croft Petroleum Company
Crown Central Petroleum Corporation
Davis Oil
Depco, Inc.
Diamond Shamrock Exploration
Eastern American Energy Corporation
Elenburg Exploration
Energetics, Inc.
Energy Reserves Group, Inc.
Energy Fuel NEEC, Inc.
Energy Reserves Group, Inc.
EPS Resources Corporation
Exxon Corporation
Fairfield Times
Frontier Exploration Company
Fuel Resources Development Company
Fulton Producing Company
Getty Oil Company
Glacier Reporter
Great Falls Tribune
Great Northern Drilling Company, Inc.
Gulf Oil Exploration and Production Company
Halliburton Company
Halliburton Services
Hardrock Oil Company
Ray Harrison Drilling
Havre News
Hickel and Tooke Drilling Company
Hicks and Sons, Inc.
High Country News
Highline Drilling Service
Homestake Oil and Gas
Husky Oil
Investestate
J. M. Resources, Inc.
Juniper Petroleum Company
Lewistown News Argus
Lightning Productions, Inc.
Luff Exploration Company
Macquest Resources, Inc.
Marathon Oil
Montana/North Dakota Utility
Exxon Coal Resources USA, Inc.
Meridian Oil, Inc.
Minden Oil and Gas, Inc.
Mobil Oil
Mobil Oil Canada LTD
Montana Magazine
Montana Pacific Oil and Gas Company
Montana Power Company
Montana Oil Journal
Montana Pacific Oil & Gas Company
Mountain Fuel
Mountain States Petroleum Corporation
Burlington Northern Railroad
Northern Pacific Oil and Gas
Petro-Lewis Corporation
Phillips Petroleum
Red River Oil and Gas, Inc.
S & W Petroleum Consultants, Inc.
S & J Operating
Schlumberger Well Service
Shadco
Shell Oil Company
Sohio Petroleum Company
Superior Oil
Union Oil Company
Western Energy Company
Western Natural Gas Company
Western Reserves, Inc.
Wildcat Oilfield Construction, Inc.
Williams Exploration Company

This document is also available at county libraries. In addition, approximately 270 copies were mailed to individuals and branch offices of the agencies and business listed above.

PREPARERS

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This EIS was prepared by an interagency interdisciplinary team. The team members are listed below.

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These people from the Lewistown District Office, the Great Falls Resource Area Office and the Montana State Office helped greatly in preparing this DEIS.

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Nancy Godwin	Earl Dahlhausen
Kathy Stoeser	Debbie Wilson

State Office Printing & Graphics

APPENDICES

APPENDIX A:

History of Exploration

There have been 17 wells drilled in the study area since the 1930s. The earliest well was drilled by the California Company along the Middle Fork of Dupuyer Creek and was the obligation well for the Federal Unit. The well was drilled in 1938 to a total depth of 2,814 feet and then abandoned. Another two wells were drilled between 1940 and 1950, one in 1947 in Sec. 14, T.26 N., R. 9. W. by General Petroleum Corporation was the unit well well for the Blackleaf Structure Unit. This well was plugged in 1948.

First Discovery

The earliest discovery of gas in the Blackleaf area was the Northern Natural Gas well in Sec. 13, T. 26 N., R. 9 W., completed in June 1958, with an initial potential of 6.3 MMCF per day. This well was shut-in after completion until 1973 when it was plugged and abandoned. In 1981 the well (the current 1-13) was reentered by Williams Exploration, recompleted and has been shut-in since that time. Another well was drilled in 1958 about a mile to the south of the Williams well. This was the Humble No. 1-13 in Sec. 19, T. 26 N., R. W., completed in 1959, with an initial potential of 969 MCF per day. In 1973 this well was also plugged and abandoned. There were six more wells drilled in this area from 1956 to 1962. After that period there were no intensive exploratory efforts until the late 70s and early 80s.

Since 1980 there have been nine wells drilled in the study area; also, the present Blackleaf Unit was formed the same year. There have been six wells drilled in the Blackleaf Unit, two of which were plugged and abandoned. The first Pamburn Unit was formed south of the Blackleaf Unit in 1981. The unit well was drilled by Wexpro in Sec. 21, T. 25 N., R. 8 W. in 1981, but was plugged and abandoned, then the unit was terminated. The second Pamburn Unit was formed in 1983, covering the same acreage as the original Pamburn Unit. The obligation well for this unit was drilled in 1984 by Celsius Energy in Sec. 27, T. 25 N., R. 8 W.. This well was also a dry hole and the unit was terminated after the well was plugged.

Unitization

The objective of unitization is to provide for unified development and operation of an entire geologic prospect so that drilling and production can proceed in the most efficient and economical manner under the administration of one operator. Unit agreements are approved under authority contained in the Mineral Leasing Act of 1920 as amended. Exploratory units, such as the Blackleaf Unit, normally embrace a prospective area which has been delineated on the basis of geological and/or geophysical inferences. At the present time, approval of units is delegated to the Montana State BLM Director. Approval of operations within the Blackleaf Unit is delegated to the Great Falls Resource Area Manager.

APPENDIX B:

Standard Management Practices

These management practices constitute a portion of each alternative considered. They are the result of existing laws, regulations, and previous planning efforts and will not be changed by any of the alternatives described in this chapter. These standard management practices (SMP), as applicable, will be appended to all future APDs within the EIS area.

Air Quality

A-1 Operators, as required by regulation (43 CFR 3612.5-1), shall prepare and incorporate measures in an H_2S contingency plan to avoid and minimize risk to the general public, project employees, property and the environment.

Paleontological Resources

P-1 Prior to any surface disturbing activity, the operator shall conduct an inventory to determine all paleontological sites on all lands where surface disturbance is to occur.

P-2 If a paleontological site is discovered during construction work, all work will stop and the Authorized Officer (AO) will be notified immediately.

Cultural Resources

C-1 Prior to any surface disturbing activity, operators, in consultation with the AO and Montana State Historic Preservation Officer (SHPO), shall conduct a Class III inventory to determine all archaeological and historical sites on all lands where surface disturbance is to occur. If there is a significant finding, the agencies shall develop a cultural resource treatment plan outlining procedures for identifying and evaluating cultural resources within the EIS area. The treatment plan will also outline methods for mitigating adverse effects to significant cultural resources that cannot be avoided.

C-2 If a cultural site is discovered during construction work, all work will stop and the AO will be notified immediately.

Soil Resources

S-1 All drill pads will be designed and constructed to disturb the smallest practical area. All precautions necessary to stabilize structures will be taken during construction. Qualified supervision will be provided during the installation of all erosion control structures including the construction of berms, dikes, trenches, and the outslope fill.

S-2 At all sites, removal and storage of subsoil and topsoil will be according to approved engineering designs submitted with the APD. Care will be taken not to mix subsoil with topsoil. Erosion will be controlled on subsoil stockpiles through appropriate construction design with mulching and/or revegetation. Whenever possible, topsoil will not be stored for extended periods (over two years) and will be used for immediate reclamation.

S-3 All disturbed areas not required for use during drilling operations will be stabilized and revegetated immediately following construction to minimize erosion of soil.

S-4 Topsoil removed from the site will be protected to maintain its viability over the life of the project by applying it to the areas of disturbance outside the working area. These areas would be reseeded according to the reclamation plan. At abandonment, necessary topsoil would then be available from these areas.

S-5 Land grading and clearing will be done only on the minimum area required for construction. Existing or constructed roads will be used for vehicle travel; no off-road use of vehicles or equipment will be allowed without the approval of the AO.

S-6 Use best management practices and design construction, determined at pre-drill inspection, to avoid increased stream sedimentation.

S-7 Use special design measures, determined at pre-drill inspection, for new cut and fill slopes where moderate to high water erosion hazards exist.

S-8 Where possible, avoid construction activities on slopes greater than 60%, and avoid well pad construction on slopes greater than 40%.

S-9 Obliteration of well pads and access roads will include removal of drainage structures and associated fill dirt to the extent necessary to pass expected flood flow.

Vegetation Resources

SMPs S-1, S-2, S-3, S-4 also apply to this resource.

VR-1 Operators will be responsible for designing and implementing a noxious plant control program. This program will be reviewed and approved by the AO prior to implementation.

VR-2 All new well field pipelines and transmission lines will be required to use common rights-of-way when economically and technically feasible.

VR-3 All areas not needed for production on the well pads will be recontoured and rehabilitated following the drilling phase for each well. The determination on necessary area for operation will be made by the AO in consultation with the operator.

VR-4 The operator shall, at all times during construction, maintenance, and operation, maintain satisfactory spark arrestors on all steam and internal combustion engines and on all flues.

VR-5 Preclearing of mountain brush and tree-covered areas prior to dozer and maintenance blade work will be required. Preclearing will involve hand cutting brush and trees and removing them to designated areas.

Livestock

L-1 Pipelines will be constructed after September 5 to lessen impacts to livestock.

L-2 Pipeline trenches will be covered as soon as possible. If pipeline trenches are to be left open for an extended period of time, they will be temporarily fenced as determined by the AO.

L-3 The reserve pit will be fenced (three stands of barb wire, 48 inches high) to exclude livestock and wildlife. Fencing will remain in place until a final disposition of drilling fluids, muds, and cuttings is approved by the AO.

L-4 Disturbance of range improvements such as fences, roads, and watering facilities during the construction and maintenance of roads and pipelines must be kept to an absolute minimum. Immediate restoration of any damage to improvements to at least their former state will be required. Functional use of these improvements must be maintained at all times. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting the fence. A gate or cattle guard acceptable to the AO shall be installed in the gate opening and kept closed when not in actual use. Where a permanent road is to be constructed or maintained, cattle guards shall be placed at all fence crossings.

L-5 If a natural barrier used for livestock control is broken during construction, the operator will adequately fence the area to prevent drift of livestock. All fencing constructed by the operator will meet BLM and FS design requirements with input from the Montana Department of Fish, Wildlife and Parks (MDFWP). Fence specifications will be determined on case-by-case basis.

Wildlife Resources

SMPs S-3, S-5, S-6, VR-1, VR-2, VR-3, L-3 and L-4 also apply to this resource.

WF-1 Any facilities (wellsites, roads, pipelines) constructed within the Blackleaf Wildlife Management Area (WMA) will be done in accordance with seasonal and other restrictions as determined by the MDFW&P.

WF-2 Staging areas for stream crossing equipment will be located outside of the riparian zone to reduce the possibility of silt entering into streams and to reduce disturbance to vegetation in the riparian zone. A maximum construction right-of-way of 25 feet will be used in riparian areas. Variances to this must be approved by the AO.

WF-3 The operator will avoid human activities in grizzly bear habitat components which provide important food sources during spring and early summer, April 1 - July 15. These habitat components include riparian shrub types, Populus stands, wet meadows, sidehill parks and avalanche chutes. Maintain an undisturbed zone of at least 1/2-mile between activities and the edge of these habitat components.

WF-4 No drilling activities will occur within 1-mile of grizzly bear den sites from October 15 to April 15.

WF-5 In grizzly bear habitat, no more than two wells will be drilled concurrently. These concurrent wells must be separated by at least a major drainage in critical areas or a minimum one mile distance, at the agencies discretion, based upon the site specific location, resources and topography.

WF-6 A July 15 - December 15 time period will be used to select a 105 day drilling window for any activity located in the areas cross-hatched on Figure 2.7, in Chapter 2 of this draft. Those areas on the eastern side of the EIS area, not cross hatched, would generally be available for year-round drilling activity unless new information reveal effects of the action may impact listed species or critical habitat in a manner or to an extent not considered in this document.

WF-7 Access roads for producing wells will be closed and locked to motorized use by the public. Access roads for non-producing wells will be rehabilitated unless otherwise approved by the AO.

WF-8 No firearms will be allowed on locations or in company vehicles. No dogs will be allowed on locations.

WF-9 Garbage will be incinerated daily or stored in bear proof containers and removed to local landfills on a daily basis.

WF-10 No off-duty work camps will be located within occupied grizzly bear seasonally important constituent elements. Crews will be bussed to/from drill sites to reduce activity levels on roads.

WF-11 Roads and drill sites will be located, as much as possible, to avoid important wildlife habitat components based on a site specific evaluation.

WF-12 Where deemed appropriate by the AO, wildlife forage and/or cover species will be used when rehabilitating drill sites and pipelines.

WF-13 Human disturbances will be minimized at raptor nesting territories during sensitive nesting phases.

Surface Water Resources

SMPs S-1, S-3, S-5, S-6, S-7, VR-3 and WF-2 also apply to this resource.

SW-1 Where possible, all construction activities will be located away from the Blackleaf Creek floodplain.

SW-2 Excavated material will be located away from free-flowing streams.

SW-3 All phases of a project, including road and drill site construction, maintenance and rehabilitation, shall be guided by the Clean Water Act. All hazardous substances, including fuels, shall be controlled so as to prevent their accidental discharge into waterways.

Groundwater Resources

GW-1 Pit liners will be used to prevent groundwater contamination.

GS-2 Freshwater aquifers will be cased and cemented to minimize migration of contaminants.

Recreation Resources

SMPs S-5, VR-3, WF-1 and WF-7 also apply to this resource.

R-1 Disturbance of recreational facilities and improvements such as signs, outhouses, stock ramps, etc., during field development must be kept to an absolute minimum. Immediate restoration of any damage to improvements to at least their former state will be required.

Visual Resources

SMPs S-1, S-3, S-5, S-8, VR-2 and VR-3 also apply to this resource.

V-1 All permanent structures (onsite longer than 90 days) will be painted a flat, non-reflective earth tone color to blend with the surrounding landscape. Exceptions to this requirement would be determined on a case-by-case basis by the AO because of varying levels of sensitivity, or structures which require safety coloration in accordance with Occupational Safety and Health Administration requirements. Color selection will be approved by the AO.

V-2 Where possible, drill sites and associated activities will take place in areas of low relief.

V-3 The generation of fugitive dust is likely. Should an air quality, visuals, soil loss or safety problem be identified (by the AO), abatement procedures will be initiated. Water will be used on roads; any additives must be approved by the AO.

V-4 When rehabilitating disturbed areas, slopes will be rounded and wrapped to resemble natural surroundings.

V-5 Within 30 days after conclusion of construction, operation, or maintenance activities, construction related litter and debris shall be disposed of in accordance with instructions from the AO.

Noise

N-1 All drill rigs and other associated equipment will utilize a muffler system capable of an average 30 dBA spectrum reduction.

Transportation System

SMPs S-5, S-6, S-8, S-9, L-4, WF-1, WF-3, WF-7, WF-11 and V-3 also apply to this resource.

TS-1 Existing arterial and collector routes will remain open to public use to maintain existing access to public lands.

TS-2 Seasonal road closures for wildlife and/or other resource protection will remain as currently managed.

TS-3 Operators will not exceed a maximum cutbank height of 6 feet unless slope stability test are conducted at each specific site and justify greater heights.

TS-4 Road grades will be kept under 6%.

TS-5 The operator will be responsible for preventive and corrective road maintenance throughout the life of the field. This may include, but not be limited to, blading roadway, cleaning ditches and drainage facilities, or other requirements as directed by the AO.

APPENDIX C

Current Stipulations On Leases

The leases within the Blackleaf Environmental Impact Statement (EIS) area restricted by stipulations on occupancy are listed by location in the following table. These stipulations are designed to protect surface resources such as soils, water and wildlife by restricting periods of activity and areas of disturbance.

Special Lease Stipulations

Lease Locations	Special Stipulations
T. 25 N., R. 9 W., sec. 1, Portions of W½, portions of SW¼SE¼; sec. 2, E½, NW¼, E½SW¼, NW¼SW¼, portions of SW¼SW¼; sec. 11, E½, E½W½, portions of W½W½; sec. 12, Portions of E½, W½; sec. 13, Portions of W½E½, W½; sec. 14, E½, E½W½, portions of W½W½, sec. 23, E½E½, portions of W½E½, portions of W½; sec. 24, Portions of W½E½, W½; sec. 25, Portions of W½E½, NW¼, N½SW¼, portions of S½SW¼; sec. 26, E½NE¼, portions of W½E½, portions of E½W½, W½NW¼, portions of W½SW¼, portions of E½SE¼; sec. 35, Portions of NE¼NE¼, W½NE¼, SE¼NE¼, W½, SE¼; sec. 36, Portions of NW¼, SW¼, portions of W½SE¼.	(1) No occupancy on slopes greater than 60%.
T. 25 N., R. 9 W., sec. 25, Portions of S½NE¼, E½SE¼, portions of W½SE¼; sec. 36, Portions of E½, portions of SE¼NW¼, portions of NE¼SW¼.	(2) In order to protect bighorn sheep winter range, occupancy will be allowed only during May 1 to November 30.
T. 25 N., R. 9 W., sec. 1, Portions of N½NE¼; sec. 14, Portions of SW¼NW¼, portions of SW¼, portions of SW¼SE¼; sec. 23, Portions of NE¼, portions of NE¼NW¼, portions of E½SE¼; sec. 24, Portions of N½SW¼; sec. 25, Portions of NW¼, portions of NE¼SW¼, portions of SE¼; sec. 26, Portions of N½.	(3) In order to protect big game migration route, occupancy will be allowed only during January 15 to April 15 and June 1 to December 1.

T. 25 N., R. 9 W., sec. 26, Portion of SE¼.	(4) No surface occupancy to protect Cave Mountain Campground.
T. 25 N., R. 9 W., sec. 2, Portions of SW¼SW¼; sec. 11, Portions of W½W½; sec. 14, Portions of W½NW¼; sec. 23, Portions of W½NW¼, portions of SE¼NW¼, portions of E½SW¼; sec. 26, Portions of E½NW¼, portions of SW¼.	(5) Limited surface use due to moderate potential for cutslope failure hazard (all year).
T. 25 N., R. 9 W., sec. 1, All; sec. 2, All; sec. 11, All; sec. 12, All; sec. 13, All; sec. 14, All; sec. 23, All; sec. 24, All; sec. 25, All; sec. 26, All; sec. 35, All; sec. 36, All.	(6) In order to minimize impacts to occupied threatened and endangered species habitat (grizzly bear, gray wolf), special conditions such as unitization prior to approval of operations, and/or other limitations to spread surface disturbance activities over time and space may be required prior to approval and commencement of any operations.
T. 26 N., R. 9 W., sec. 12, SE¼SW¼, S½SE¼; sec. 24, NE¼, N½SE¼, SE¼SE¼.	(6) [1]
T. 26 N., R. 9 W., sec. 13, NE¼.	(6) (7) In order to protect elk and mule deer winter range, surface occupancy will be allowed only during May 1 to December 1. (8) In order to protect big game migration routes in the N½NE¼, surface occupancy will be allowed only during January 15 to April 15 and June 1 to December 1.

T. 26 N., R. 9 W., sec. 12, Portions of W½SE¼SW¼; sec. 24, Portions of E½NE¼, portions of N½SE¼, portions of SE¼SE¼.	(1)
T. 26 N., R. 9 W., sec. 12, S½SE¼; sec. 24, NE¼, W½SE¼, SE¼SE¼.	(7)
T. 26 N., R. 9 W., sec. 24, E½E½.	(9) In order to protect elk calving areas, surface occupancy will be allowed only during July 1 to April 30.
T. 26 N., R. 9 W., sec. 13, Portions of N½NW¼, portions of SW¼NW¼, portions of S½.	(1)
T. 26 N., R. 9 W., sec. 13, NW¼NW¼, S½NW¼, N½SW¼, portions of SW¼SW¼, SE¼SW¼, SE¼.	(7)
T. 26 N., R. 9 W., sec. 13, Portions of E½SE¼.	(9)
T. 26 N., R. 9 W., sec. 13, NW¼S½.	(6)

T. 26 N., R. 8 W., sec. 30, NE¼ of lot 2, SW¼SW¼NE¼, NW¼SE¼NW¼, S½SE¼NW¼, NE¼NE¼SW¼, NW¼NW¼SE¼, SW¼NW¼SE¼, W½SE¼NW¼SE¼, W½NE¼SW¼SE¼, E½NW¼SW¼SE¼, E½SW¼SW¼SE¼, W½SE¼SW¼SE¼. sec. 31, N½NW¼NE¼, SE¼NW¼NE¼, E½NE¼SE¼, N½NE¼SE¼SE¼.	(10) No on-the-ground overland access for conveyance of drilling equipment is permitted. Aerial conveyance of drilling equipment, and onsite drilling, is permitted. (11) No new roads/trails permitted for exploratory seismic activity.
T. 26 N., R. 8 W., sec. 19, E½SW¼, W½SE¼.	(12) Surface exploration and production activities will only be allowed within the floodplain of Muddy Creek. (13) No wells to be drilled within 75 feet of the defined main channel of Muddy Creek. (14) Drilling activities will not be allowed from March 15 to April 30.
T. 26 N., R. 9 W., sec. 2, Portions of SW¼NE¼, portions of W½NW¼, portions of SE¼NW¼, portions of N½SW¼, portions of E½SE¼, W½SE¼; sec. 3, Portions of S½NE¼; sec. 10, Portions of NE¼, portions NE¼NW¼, N½SE¼, portions of SE¼SE¼; sec. 11, Portions of NE¼, portions of W½W½, portions of E½SE¼; sec. 12, Portions of W½W½; sec. 14, Portions of SE¼NE¼, portions of S½S½, portions of NE¼SE¼; sec. 15, Portions of E½NE¼, portions of SE¼SE¼; sec. 23, Portions of N½NE¼, portions of NE¼NW¼, W½W½, portions of NE¼SW¼, SE¼SW¼, portions of SW¼SE¼; sec. 24, Portions of NE¼SW¼, portions of SW¼SE¼;	(1)

sec. 25, Portions of NE¼NE¼,
portions of SW¼;
sec. 26, Portions of NE¼, W½, SE¼;
sec. 35, All;
sec. 36, Portions of E½NW¼,
W½W½, E½SW¼,
portions of W½SE¼.

T. 26 N., R. 9 W.,
sec. 1, All; (7)
sec. 2, N½N½, portions of SE¼NE¼,
SW¼NW¼, W½SW¼, portions of
E½SW¼, portions of NE¼SE¼;
sec. 3, N½, N½SW¼, portions of SE¼;
sec. 10, Portions of E½NE¼,
portions of SE¼SE¼;
sec. 11, Portions of E½NW¼,
W½NW¼, portions of SW¼,
portions of SE¼;
sec. 12, NE¼, E½NW¼, portions of NW¼NW¼,
portions of NE¼SW¼;
sec. 14, N½, portions of N½S½;
sec. 15, E½NE¼, portions of NE¼SE¼.
sec. 24, E½W½, portions of W½W½,
SW¼SE¼;
sec. 25, E½, E½NW¼, portions of W½NW¼,
portions of E½SW¼;
sec. 36, Portions of NE¼, portions of
NE¼NW¼, portions of NE¼SE¼.

T. 26 N., R. 9 W.,
sec. 2, Portions of NW¼NE¼,
portions of N½NW¼.

(15) In order to protect raptor nesting sites, occupancy will be allowed only during July 16 to February 28.

T. 26 N., R. 9 W.,
sec. 14, Portions of N½; (3)
sec. 26, Portions of SW¼,
portions of SW¼SE¼;
sec. 35, Portions of NE¼,
portions of NE¼NW¼;
sec. 36, Portions of SW¼NW¼,
portions of N½SW¼,
portions of SE¼SW¼,
portions of S½SE¼.

T. 26 N., R. 9 W.,
sec. 25, Portions of E½E½. (9)

T. 26 N., R. 9 W.,
sec. 3, Portions of NE¼, (5)
portions of S½NW¼,
portions of N½SW¼.

T. 26 N., R. 9 W.,
sec. 1, All; (6)
sec. 2, All;
sec. 3, E½, NW¼, N½SW¼,
SE¼SW¼;
sec. 10, NE¼, NE¼NW¼, N½SE¼,
SE¼SE¼;
sec. 11, All;
sec. 12, N½, N½S½, SW¼SW¼;
sec. 14, All;
sec. 15, E½E½;
sec. 23, All;
sec. 24, W½, SW¼SE¼;
sec. 25, All;
sec. 26, All;
sec. 35, All;
sec. 36, All.

T. 27 N., R. 9 W.,
sec. 23, Lots 1-4, S½N½, (6)
E½SW¼, SE¼;
sec. 24, Lot 2;
sec. 26, NE¼, NE¼NW¼, S½NW¼, S½;
sec. 35, N½.

T. 27 N., R. 9 W.,
sec. 11, SE¼NE¼, SE¼; (6)
sec. 13, S½NE¼, N½S½;
sec. 14, W½NE¼, SE¼NW¼;
sec. 15, Lots 2-7, NE¼SW¼,
NW¼SE¼.

(16) Limited surface use for protection of habitat for the threatened grizzly bear as well as protection of recovery habitat for the gray wolf, January 1 to October 1.

T. 27 N., R. 9 W.,
sec. 11, SE¼NE¼, SE¼;
sec. 13, S½NE¼, N½S½;
sec. 14, W½NE¼, SE¼NW¼.

(17) In order to protect grizzly bear and gray wolf, exploration and drilling will be allowed only during October 1 to December 30.

T. 27 N. R. 9 W.,
sec. 16, Portions of $W\frac{1}{2}SW\frac{1}{4}$; (1)
sec. 21, Portions of $E\frac{1}{2}W\frac{1}{2}$, $W\frac{1}{2}W\frac{1}{2}$;
sec. 28, Portions of $W\frac{1}{2}NW\frac{1}{4}$,
portions of $E\frac{1}{2}SW\frac{1}{4}$;
sec. 33, Portions of $NW\frac{1}{4}NE\frac{1}{4}$;
sec. 35, Portions of $SW\frac{1}{4}$,
portions of $SE\frac{1}{4}SE\frac{1}{4}$.

T. 27 N., R. 9 W.,
sec. 9, Lots 3, 4, $S\frac{1}{2}NW\frac{1}{4}$, $S\frac{1}{2}$; (7)
sec. 16, All;
sec. 21, $E\frac{1}{2}$, portions of $N\frac{1}{2}NW\frac{1}{4}$,
portions of $SE\frac{1}{4}NW\frac{1}{4}$;
sec. 22, All;
sec. 23, $W\frac{1}{2}SW\frac{1}{4}$;
sec. 27, $N\frac{1}{2}$, $N\frac{1}{2}SW\frac{1}{4}$, portions of
$S\frac{1}{2}SW\frac{1}{4}$, $SE\frac{1}{4}$.

T. 27 N., R. 9 W.,
Sec. 35, Portions of $E\frac{1}{2}SW\frac{1}{4}$, (15)
portions of $W\frac{1}{2}SE\frac{1}{4}$.

T. 27 N., R. 9 W.,
sec. 26, $NW\frac{1}{4}NW\frac{1}{4}$; (3)
sec. 27, Portions of $N\frac{1}{2}$;
sec. 28, Portions of $S\frac{1}{2}NE\frac{1}{4}$,
portions of $SE\frac{1}{4}NW\frac{1}{4}$,
portions of $NE\frac{1}{4}SW\frac{1}{4}$,
portions of $N\frac{1}{2}SE\frac{1}{4}$.

T. 27 N., R. 9 W.,
sec. 21, Portions of $SW\frac{1}{4}NW\frac{1}{4}$, $SW\frac{1}{4}$; (2)
sec. 28, $N\frac{1}{2}NW\frac{1}{4}$, portions of $S\frac{1}{2}NW\frac{1}{4}$.

T. 27 N., R. 9 W.,
sec. 9, Lots 1 and 2, (9)
portions of $SW\frac{1}{4}NW\frac{1}{4}$, $SE\frac{1}{4}NW\frac{1}{4}$,
portions of $E\frac{1}{2}SW\frac{1}{4}$, $SE\frac{1}{4}$;
sec. 16, $E\frac{1}{2}E\frac{1}{2}$, portions of $W\frac{1}{2}E\frac{1}{2}$,
portions of $NE\frac{1}{4}NW\frac{1}{4}$;
sec. 21, Portions of $NE\frac{1}{4}NE\frac{1}{4}$;
sec. 22, Lots 2-4, portions of $SW\frac{1}{4}NE\frac{1}{4}$,
portions of $S\frac{1}{2}NW\frac{1}{4}$;
sec. 28, $NE\frac{1}{4}$, $N\frac{1}{2}SE\frac{1}{4}$;
sec. 33, Portions of $SE\frac{1}{4}SE\frac{1}{4}$;
sec. 34, $E\frac{1}{2}E\frac{1}{2}$, portions of $NW\frac{1}{4}NE\frac{1}{4}$,
portions of $S\frac{1}{2}SW\frac{1}{4}$,
portions of $SW\frac{1}{4}SE\frac{1}{4}$;
sec. 35, $S\frac{1}{2}$.

T. 27 N., R. 9 W.,
sec. 9, Lots 3 and 4, $S\frac{1}{2}NW\frac{1}{4}$, $S\frac{1}{2}$; (6)
sec. 16, All;
sec. 21, All;
sec. 22, Lots 1-4, $S\frac{1}{2}N\frac{1}{2}$, $S\frac{1}{2}$;
sec. 23, $W\frac{1}{2}SW\frac{1}{4}$;
sec. 26, $NW\frac{1}{4}NW\frac{1}{4}$;
sec. 27, All;
sec. 28, $N\frac{1}{2}$, $E\frac{1}{2}SW\frac{1}{4}$, $SE\frac{1}{4}$;
sec. 33, $NE\frac{1}{4}$, $E\frac{1}{2}SE\frac{1}{4}$;
sec. 34, All;
sec. 35, $S\frac{1}{2}$.

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[1] Stipulations are described as they first appear in the table; thereafter, they are referenced by number.

APPENDIX D:
CENTRAL GAS PROCESSING FACILITY

The gas processing facility would be constructed in the NE§ of Sec. 8, T. 26 N., R. 8 W. The EPS Resources Company (EPS) Blackleaf Canyon Gas Treatment Plant will be designed and built to process approximately 10 million cubic feet per day (10 MMCFD) of hydrogen sulfide bearing (sour) natural gas produced from wells in the area. Its purpose would be to remove the hydrogen sulfide and other sulfur bearing compounds and carbon dioxide from the produced gas to render it suitable for sales. It would replace existing wellsite gas production facilities and liquid storage tanks. The plant would require a State of Montana Air Quality Permit prior to its construction.

The EPS plant would consist of two main processes-sweetening towers for removing the hydrogen sulfide from the produced gas and re-injection of the waste acid gas into the same reservoir from which it came. There would be no pollutants emitted into the atmosphere with this "closed system" process. The sweetening of the gas would be done by an amine plant process. In this plant the produced gas stream would come into contact with an organic based solution, the amine solution, in a process tower. The amine solution has an affinity for hydrogen sulfide and carbon dioxide (acid gases) and would act to remove those components from the gas stream. The gas leaving the top of the process tower would be suitable for sales.

The amine solution that leaves the bottom of the process tower is H_2S and CO_2-rich, that is, it has absorbed all of the undesirable (acid) gas from the produced gas stream. The pressure of the solution is then greatly lowered and heated to a higher temperature. This acts to reverse the absorption that took place in the tower and releases the hydrogen sulfide and carbon dioxide from the solution. The amine is now regenerated and ready to be reused in the process contact tower. Refer to Figure D-1 for a schematic of the amine process showing a simplified flow path through this plant.

The acid gas released from the amine during the sweetening process is usually sent to a sour gas flare and burned off. In this plant, the acid gas will be compressed and injected into an existing Madison formation well to be converted to a disposal well (1-16). This will accomplish two things: (1) there will be no pollutants emitted into the atmosphere; and (2) the acid gas will act to re-pressurize the Sun River dolomite section of the Madison Reservoir to maximize hydro-carbon recoveries. A sour gas flare will only be used during upset or problem situations.

Finally, to accomplish water removal, the sales gas stream is then sent through a process known as dehydration. In this part of the plant, the gas will come into contact with a glycol solution in a vertical process contact tower. Glycol is another organic based solution, but one that has a strong affinity for water vapor. In the main process tower, the sales gas stream is stripped of its water vapor and leaves the tower sufficiently dehydrated to be sold.

The glycol solution leaving the bottom of the tower is water-rich; that is, it has absorbed and contains the water vapor from the gas. It is then subjected to a much lower pressure and higher temperature (275 F.) that causes all the entrained water to be boiled away. The water vapor is vented to the atmosphere and the resulting solution is cooled and recirculated back into the main process tower.

To aid in the coordinating of all the plant equipment, a central electronic monitoring and control system will be installed at the plant. Various flows through the plant such as inlet gas, acid gas to the compressor, fuel gas consumed and final sales gas volumes will be constantly monitored on a continual basis. In addition, certain critical pressures and temperatures, as well as process solution chemical concentrations, will also be monitored continously to provide a check on the operation of the plant. This system will provide the plant operators with up-to-date information necessary to keep the plant operating at maximum efficiency and greatly reduce the amount of human visitation to the wellsites.

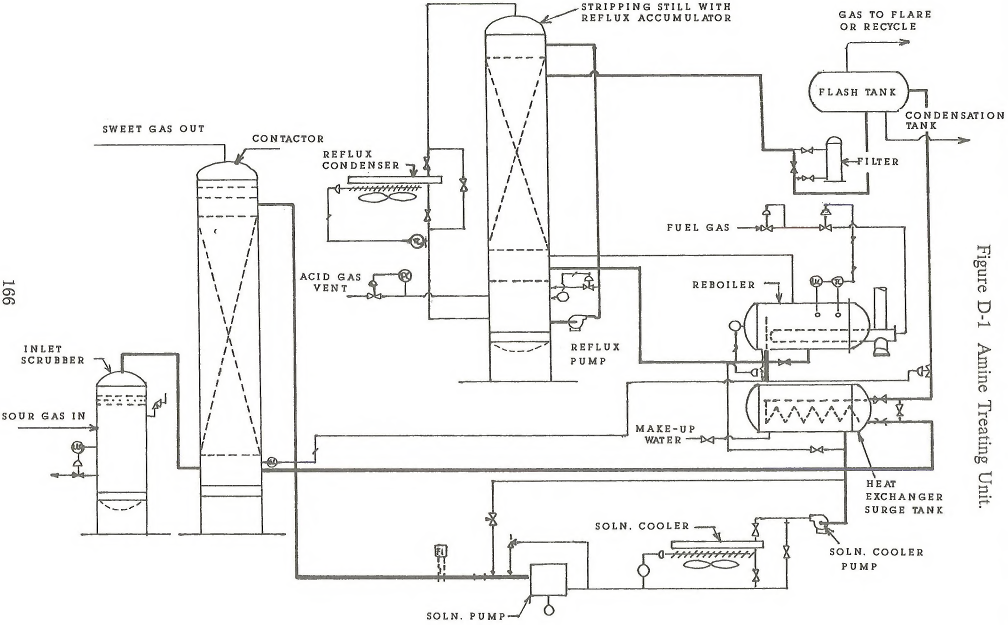


Figure D-1 Amine Treating Unit.

APPENDIX E:

Blackleaf EIS Area Reserves; Methodology and Calculations

This Appendix describes the method used to determine the total reserves in the EIS area, and contains calculations and tables of reserve estimates for each well proposed in each alternative.

Background for calculating the reserves in the Blackleaf EIS area:

Sections were rated high, medium, or low based on the following definitions:

Low (L) - Either previously explored or no future drilling applications are expected. Previous drilling did not yield shows.

Medium (M) - Hasn't been drilled; is near structure.

High (H)- Drilling has been proposed at one time or another or it appears to be a logical place based on geology to test the extent of a structure; previous drilling yielded significant shows.

Geologic maps and cross sections from several sources including the Montana Geologic Society (MGS) Bulletin, 1985, and Williams Exploration Company were used in the geologic evaluations.

Reservoir Values:

Reservoir values from the MGS Bulletin, 1985 were used to determine the high value for potential reserves (350 feet of pay and 167 MCF of gas per acre/foot).

Superior Oil figures were used to calculate the low value for potential reserves (350 feet of pay and 65 MCF of gas per acre/foot).

For a high section, 30% of the area was estimated to have recoverable reserves.

For a medium section, 15% of the area was estimated to have recoverable reserves.

For a low section, 10% of the area was estimated to have recoverable reserves.

Each section was considered to be 640 acres in size.

The following list shows the classification of each section within the EIS boundary:

Section	Township	Range	Status
9	27N	9W	M - along the west edge of a surface fault
10	27N	9W	L - east of fault line and no interest shown in this area by companies that th agencies are aware of
11	27N	9W	L - east of a fault line and no interest shown in this area by companies that th agencies area aware of
12	27N	9W	M - near a fault line
13	27N	9W	M - near a fault line
14	27N	9W	L - between two faults
15	27N	9W	M - west of a fault line and covers part of a surface fault
16	27N	9W	L - (M) trend of structure is possibly NW-SE
21	27N	9W	L - (M) trend of structure is possibly NW-SE
22	27N	9W	M - is on trend of general structure, is on a fold
23	27N	9W	L - dry hold has been drilled
24	27N	9W	L - based on cross section, there doesn't appear to have any subsurface faulting t produce traps
25	27N	9W	L - based on cross section, there doesn't appear to have any subsurface faulting t produce traps
26	27N	9W	H - on a fold-gas shows in both wells drilled in section
27	27N	9W	H - on a fold
28	27N	9W	L - appears to be on the end of a structure
33	27N	9W	L - structural complexity
34	27N	9W	M - possibly higher on structure
35	27N	9W	H - on a fold, possibly high on structure
36	27N	9W	M - near a fault line
30	27N	8W	M - associated with a fault
31	27N	8W	L - fault north of dry hole in Section 5
32	27N	8W	L - see above, also outside of thrust belt
4	26N	8W	L - outside of thrust belt
5	26N	8W	L - has a producing well and one dry hole
6	26N	8W	L - not associated with a structure
7	26N	8W	L - not associated with a structure
8	26N	8W	L - producing gas well in this section
9	26N	8W	L - outside thrust belt
15	26N	8W	L - outside thrust belt
16	26N	8W	L - temporarily abandoned gas well in this section
17	26N	8W	L - not associated with structure
18	26N	8W	L - dry hole
19	26N	8W	L - shut-in gas well
20	26N	8W	L - not associated with a structure
21	26N	8W	H - possible structure
22	26N	8W	L - outside thrust belt
27	26N	8W	L - not associated with a structure
28	26N	8W	M - associated with a structure
29	26N	8W	M - associated with a structure
30	26N	8W	H - well proposed in past appears to be on structural trend
31	26N	8W	M - possible structure
32	26N	8W	H - possible high on structure
33	26N	8W	M - possible structure
34	26N	8W	L - not associated with a structure
1	26N	9W	H - apparently on structure with 1-13 well
2	26N	9W	H - apparently on structure with 1-13 well
3	26N	9W	L - off structure
10	26N	9W	L - off structure, complex
11	26N	9W	H - drilling proposed in past
12	26N	9W	H - on structure
13	26N	9W	L - shut-in gas well
14	26N	9W	L - plugged and abandoned off structure
15	26N	9W	L - off structure
23	26N	9W	L - off structure

24	26N	9W	H -	drilling proposed, permit expired
25	26N	9W	M -	on structure
26	26N	9W	L -	off structure
35	26N	9W	L -	off structure
36	26N	9W	L -	off structure
3	25N	8W	L -	near edge of thrust belt
4	25N	8W	M -	on possible structure
5	25N	8W	L -	plugged and abandoned well
6	25N	8W	M -	on structure, higher than 5 above
7	25N	8W	M -	on structure
8	25N	8W	L -	off structure
9	25N	8W	M -	on structure
10	25N	8W	L -	apparently not associated with structure, dry hole to north
15	25N	8W	L -	apparently not associated with structure, dry hole to north
16	25N	8W	M -	apparently on structure
17	25N	8W	M -	apparently on structure
18	25N	8W	M -	apparently on structure
19	25N	8W	L -	off structure
20	25N	8W	M -	on structure
21	25N	8W	L -	plugged and abandoned well
22	25N	8W	L -	apparently no structure
27	25N	8W	L -	plugged and abandoned well
28	25N	8W	M -	on structure
29	25N	8W	M -	on structure
30	25N	8W	L -	off structure
31	25N	8W	L -	off structure
32	25N	8W	M -	on structure
33	25N	8W	M -	on structure
1	25N	9W	L -	off structure
2	25N	9W	L -	Subbelt II, complex
12	25N	9W	L -	off structure & getting into Subbelt II
13	25N	9W	L -	off structure
24	25N	9W	L -	off structure
25	25N	9W	L -	off structure

In total there are 11 high potential sections, 25 medium potential, and 53 low potential sections. This equates to 7,040 acres of high potential, 16,000 acres of medium potential and 33,920 acres of low potential.

Productive Acres

7,040 x 30% = 2,112 productive acres
16,000 x 15% = 2,400 productive acres
33,920 x 1% = 339.2 productive acres
Total 4,851.2 productive acres

Low Reserve Estimate

4,851.2 acres x 65 MCF/acre-foot x 350 feet = 110,364,800 MCF or approx. 110 BCF

High Reserve Estimate

4,851.2 acres x 167 MCF/acre-foot x 350 feet = 283,552,640 MCF or approx. 284 BCF

To calculate the actual production from each well proposed under the different alternatives, actual production figures, declines and initial production values were used.

For 1-5 actual production: 100,000 MCF/month (65% IP)
IP=153,000 MCF/month
actual decline 1% month

For 1-8 actual production: 112,000 MCF/month (40%IP) IP=270,000 MCF/month
actual decline 2% month

For high production scenario assume 1%/month decline rate
For low production scenario assume 2%/month decline rate

Assume actual initial production is 50% of tested IP
Assume abandonment rate of 3000 MCF/month

For 1-13 Use the average IP of the two wells drilled in Section 13
#1 in 1958-IP 6.297 MMCF
#1-13 in 1981-IP 1.400 MMCF
average = 3850 MCF/day =115,500 MCF/month
assume 50% for actual production
115,500 X .5 = 57,500 MCF/month

For 1-19 Use IP of 4.074 MMCF/day
4074 MCF/Day = 122,000 MCF/month
assume actual production equals 50% of IP
122,000 X .5 = 61,000 MCF/month

For B-1 Use average IP of the two wells drilled in Section 19. The B-1 969 MCF/day and the 1-19 4074 MCF/day. The average = 75,600 MCF/month
Assume actual production equals 50% of IP
75,600 X .5 = 37,800 MCF/month

The above assumptions and production values and the following formulas were; used to calculate the High and Low production estimates and the well lives for the 1-5, 1-8, 1-13, 1-19, and B-1 wells listed in Table E-1.

$$Gp = \frac{12(qi - qf)}{D}$$

$$T = \frac{\ln(qi/qf)}{D}$$

Where qi= actual initial monthly production
qf= abandonment rate (3000mcf/month)
D = Decline rate per year
T = Productive life in years
ln= the natural logarithm

1-5 High

$$\frac{12(100{,}000-3000)}{.12} = Gp = 9.7 \text{ BCF}$$

$$\frac{\ln(100{,}000/3000)}{.12} = T = 29 \text{ years}$$

1-5 Low

$$\frac{12(100{,}000-3000)}{.24} = Gp = 4.9 \text{ BCF}$$

$$\frac{\ln(100{,}000/3000)}{.24} = T = 15 \text{ years}$$

1-8 High

$$\frac{12\ (112{,}000-3000)}{.12} = Gp = 10.9 \text{ BCF}$$

$$\frac{\ln(112{,}000/3000)}{.12} = T = 30 \text{ years}$$

1-8 Low

$$\frac{12\ 112{,}000-3000}{.24} = Gp = 5.5 \text{ BCF}$$

$$\frac{\ln(112{,}000/3000)}{.24} = T = 15 \text{ years}$$

1-13 High

$$\frac{12(57500-3000)}{.12} = Gp = 5.5 \text{ BCF}$$

$$\frac{\ln(57500/3000)}{.12} = T = 25 \text{ years}$$

1-13 Low

$$\frac{12(57500-3000)}{.24} = Gp = 2.8 \text{ BCF}$$

$$\frac{\ln(57500/3000)}{.24} = T = 13 \text{ years}$$

1-19 High

$$\frac{12(61000/3000)}{.12} = Gp = 5.8 \text{ BCF}$$

$$\frac{\ln(61000/3000)}{.12} = T = 25 \text{ years}$$

1-19 Low

$$\frac{12(61000-3000)}{.24} = Gp = 2.9 \text{ BCF}$$

$$\frac{\ln(61000/3000)}{.24} = T = 13 \text{ years}$$

B-1 High

$$\frac{12(37{,}800-3000)}{.12} = Gp = 3.5 \text{ BCF}$$

$$\frac{\ln(37{,}800/3000)}{.12} = T = 21 \text{ years}$$

B-1 Low

$$\frac{12(37800-3000)}{.24} = Gp = 1.7 \text{ BCF}$$

$$\frac{\ln(37800/3000)}{.24} = T = 11 \text{ years}$$

Table E-1: Existing Wells High and Low Production Estimates

Well Number	High Production Estimate	Low Production Estimate
1-5	9.7	4.9
1-8	10.9	5.5
1-13	5.5	2.8
1-19	5.8	2.9
B-1*	3.5	1.7

* For these calculations the B-1 was considered existing because a production potential is known.

Site selection for the step-out and exploration wells is based on corporate information, geologic interpretations, topographic constraints, and the project geologist's and engineer's professional opinions.

The estimated high production values for each step-out well is based on a recovery percentage of the estimated drainage area for each well. The drainage area was estimated based on geologic and engineering parameters of the well site. In all cases a net pay of 350 feet, recoverable reserves of 167 MCF per acre foot, and a decline rate of 12% is assumed. Table E-2 lists the various values for each of the step-out wells.

Low reserve estimates for the step out and exploration wells are assumed to be zero for all alternatives.

High reserve calculations for Alternative 2 (least restrictive) form the basis for reserve, initial production, and well life calculations in Alternatives 1, 3, and 4.

Decrease in high production values is based on back pressures caused by increased pipelining distances and cost increases/decreases associated with each alternative.

Tables E-2 through E-9 list the reserve potential for each of the step-out wells proposed for the four alternatives.

Table E-2

High Reserve and Well Life Estimates for Step Out Wells

WELL NUMBER	LOCATION	ESTIMATED ACRES DRAINED 1/	ESTIMATED RESERVES* (BCF) (Based on 58450 MCF/Acre) 2/	ESTIMATED PRODUCIBLE RESERVES (Gp) (MCF) (55-60% of Est. Reserves)	INITIAL PRODUCTION (qi) $qi = \frac{Gp(MCF)^{*}.d}{12} + qf$ DECLINE (d)=12% ECONOMIC LIMIT (qf)=3000MCF/Month	ESTIMATED WELL LIFE $T = \frac{1N(qi/qf)}{d}$
S-1	21-26N-8W	280	16.1	9,200,000	95,000	29
S-2 (ALT. 2)	32-26N-8W	440	25.8	14,700,000	150,000	33
*S-2 (ALT. 4)	32-26N-8W	550	32.1	19,300,000		
S-3	24-26N-8W	135	7.9	4,500,000	48,000	23
S-4 (ALT. 2)	30-26N-9W	410	24.2	13,800,000	141,000	32
*S-4 (ALT. 4)	19-26N-8W	145	8.5	5,000,000		
S-5	12-26N-8W	240	14.0	8,000,000	83,000	28
S-6	1-26N-9W	300	17.5	10,000,000	103,000	29
S-7	2-26N-9W	140	8.2	4,700,000	50,000	23
S-8	35-26N-9W	160	9.3	5,300,000	56,000	24

1/ Area of drainage estimated based on a radius of drainage, fault interpretation and predicted interference.

2/ Montana Geologic Society Bulletin based on 167MCF/Acre-ft and 350 feet of pay.

* Sites S-2 and S-4 were located differently for Alternative 4.

Table E-3

High Reserve and Well Life Estimates for Alternative 1 Existing Wells

WELL NUMBER	LOCATION	ESTIMATED PRODUCIBLE RESERVES (BCF) BASED CENTRAL PROCESSING FACILITY ON LOCATION ALTERNATIVE 2)	ESTIMATED REDUCTION IN PRODUCTION AMOUNTS BASED ON CENTRAL PROCESSING FACILITIES 1/	HIGH RESERVES ESTIMATE (MCF)	INITIAL PRODUCTION (qi) MCF/MONTH $qi = Gp(MCF)d + qf$ DECLINE(d)=12% qf=3000MCF/MONTH	ESTIMATED WELL LIFE (YEARS) $T = \frac{\ln(qi/qf)}{d}$
1-5	5-26N-8W	9.7	10%	8,700,000	90,000	28
1-8	8-26N-8W	10.9	10%	9,800,000	101,000	29
1-13	13-26N-9W	5.5	25%	4,100,000	44,000	22
1-19	19-26N-8W	5.8	25%	4,400,000	47,000	23

1/ These estimates are based on increased backpressure on well due to pipeline length; increase costs for piping requirements, decrease in cost for decrease in production facilities.

Table E-4

Low Reserve Estimates for Alternatives 1 and 3 Existing Wells 1/

WELL NUMBER	LOCATION	ESTIMATED LOW PRODUCIBLE RESERVES (TABLE 1)(BCF)	ESTIMATED REDUCTION IN PRODUCTION AMOUNTS BASED ON CENTRAL PROCESSING FACILITIES 2/	ALTERNATIVES 1 & 3 LOW RESERVE ESTIMATE (BCF)
1-5	5-26N-8W	4.9	10%	4.4
1-8	8-26N-8W	5.5	10%	5.0
1-13	13-26N-9W	2.8	25%	2.1
1-19	19-26N-8W	2.9	25%	2.2

1/ Low reserves for step-out wells are assumed to be zero.

2/ These estimates are based on increased backpressure on well due to pipeline length; increase costs for piping requirements, decrease in cost for decrease in production facilities.

Table E-5

High Reserve and Well Life Estimates for Alternative 2 Existing Wells 1/
(Production Facilities Located on Well Site)

WELL NUMBER	LOCATION	INITIAL PRODUCTION (qi) MCF/MONTH	ESTIMATED PRODUCIBLE RESERVES (Gp) MCF $qi=\frac{Gp(MCF).d+qf}{12}$ (DECLINE (d)=12% ECONOMIC LIMIT (qf)=3000MCF/MONTH	ESTIMATED WELL LIFE $T=\frac{\ln(qi/qf)}{d}$ qf=3000MCI/MONTH d=12%
1-5	5-26N-8W	100,000	9,700,000	29
1-8	8-26N-8W	112,500	10,790,000	30
1-13	13-26N-9W	57,500	5,500,000	25
1-19	19-26N-8W	61,000	5,800,000	25
B-1	19-26N-8W	37,800	3,500,000	21

1/ Low reserve estimates for Alternative 2 existing wells are found in Table E-1.

Table E-6

High Reserve and Well Life Estimates for Alternative 2 Step Out Wells
(Production Facilities Located on Well Site)

WELL NUMBER	LOCATION	ESTIMATED PRODUCIBLE RESERVES (Gp) MCF	INITIAL PRODUCTION (qi) $qi=\frac{Gp(MCF).d+qf}{12}$ (DECLINE (d)=12% ECONOMIC LIMIT (qf)=3000MCF/MONTH	ESTIMATED WELL LIFE T=ln(qi/qf)
S-1	21-26N-8W	9,200,000	95,000	29
S-2	21-26N-8W	14,700,000	150,000	33
S-3	32-26N-8W	4,500,000	48,000	23
S-4	24-26N-9W	13,800,000	141,000	32
S-5	30-26N-8W	8,000,000	83,000	28
S-6	12-26N-9W	10,000,000	103,000	29
S-7	1-26N-9W	4,700,000	50,000	23
S-8	2-26N-9W	5,300,000	56,000	24

Table E-7

High Reserve and Well Life Estimates for Alternative 3 Existing Wells and Step-out Wells 1/

WELL NUMBER	LOCATION	ESTIMATED PRODUCIBLE RESERVES (BCF) BASED ON PRODUCTION EQUIPMENT ON LOCATION (ALTERNATIVE 2)	ESTIMATED REDUCTION IN PRODUCTION AMOUNTS BASED ON CENTRAL PROCESSING FACILITIES 2/	ALTERNATIVE 3 HIGH RESERVES ESTIMATE (MCF)	INITIAL PRODUCTION (qi) MCF/MONTH $qi=\frac{Gp(MCF)d+qf}{12}$ D=12% qf=300MCXF/MONTH	ESTIMATED LIFE OF WELL $T=\frac{\ln(qi/qf)}{d}$
1-5	5-26N-8W	9.7	10%	8,700,000	90,000	28
1-8	8-26N-8W	10.9	10%	9,800,000	101,000	29
1-13	13-26N-9W	5.5	25%	4,100,000	44,000	22
1-19	19-26N-8W	5.8	25%	4,400,000	47,000	23
S-1	21-26N-8W	9.2	25%	6,900,000	72,000	26
S-2	32-26N-8W	14.7	25%	11,000,000	113,000	30

1/ For Low reserve estimates see Table E-4.

2/ These estimates are based on increased backpressure on well due to pipeline length; increase costs for piping requirements, decrease in cost for decrease in production facilities.

Table E-8

High Reserve and Well Life Estimates for Alternative 4 Existing Wells and Step-out Wells

WELL NUMBER	LOCATION	ESTIMATED PROOOUCIBLE RESERVES (BCF) BASED ON PROOUCTION EQUIPMENT ON LOCATION (ALTERNATIVE 2)	ESTIMATEO REDUCTION IN PRODUCTION AMOUNTS BASED ON CENTRAL PROCESSING FACILITIES1/	ALTERNATIVE 3 HIGH RESERVES ESTIMATE (MCF)	INITIAL PROOUCTION (qi) MCF/MONTH $qi=\frac{Gp(MCF)d+qf}{12}$ D=12% qf=300MCXF/MONTH	ESTIMATED LIFE OF WELL $T=\frac{\ln(qi/qf)}{d}$
1-5	5-26N-8W	9.7	10%	8,700,000	90,000	28
1-8	8-26N-8W	10.9	10%	9,800,000	101,000	29
1-13	13-26N-9W	5.5	25%	4,100,000	44,000	22
1-19	19-26N-8W	5.8	25%	4,400,000	47,000	23
B-1	19-26N-8W	3.5	25%	2,600,000	29,000	19
S-1	21-26N-8W	9.2	25%	6,900,000	72,000	26
2/S-2	32-26N-8W	19.3*	25%	14,500,000	148,000	32
S-3	24-26N-8W	4.5	25%	3,400,000	37,000	21
3/S-4	19-26N-8W	5.0	25%	3,800,000	41,000	22
S-5	12-26N-9W	8.0	25%	6,000,000	63,000	25
S-8	35-26N-9W	5.3	25%	4,000,000	43,000	22

1/ These estimates are based on incressed backpressure on well due to pipeline length; increased costs for piping requirements, decreased costs for decrease in production facilities, and increased operating costs for remote monitoring.

2/ Well location has been moved for this alternative resulting in sn estimate of greater producible reserves.

3/ Well location has been moved for this alternatiave resulting in an estimate of significantly less producible reserves.

* Estmisted reserves based on 550 acres drained at 58450 MCF/Acre (see Table E-1)

Table E-9

Low Reserve Estimates for Alternative 4 Existing Wells

WELL NUMBER	LOCATION	ESTIMATED PRODUCIBLE RESERVES (BCF) BASEO ON PRODUCTION EQUIPMENT ON LOCATION (ALTERNATIVE 2)	ESTIMATEO REDUCTION IN PRODUCTION AMOUNTS BASED ON CENTRAL PROCESSING FACILITIES1/	ALTERNATIVE 4 LOW RESERVES ESTIMATE (BCF)
1-5	5-26N-8W	4.9	10%	4.4
1-8	8-26N-8W	5.5	10%	5.0
1-13	13-26N-9W	2.8	25%	2.1
1-19	19-26N-8W	2.9	25%	2.2
B-1	19-26N-8W	1.7	25%	1.3

1/ These estimates are based on increased bsckpressure on well due to pipeline length; increase costs for piping requirements, decrease in cost for decrease in production facilities.

APPENDIX F:

Methodology (Wildlife)

This Appendix item refers the reader to Figure 2.7 in Chapter 2 of this EIS for additional information.

Because of the great variety and abundance of wildlife and wildlife habitats in the EIS area, especially adjacent to and west of the huge rock reefs of the face of the Front (Area A of Figure 2.7) it's extremely difficult to position a human activity such as oil and gas development activities. Since this portion of the EIS area contains over-lapping habitats and zones of influence for most of the wildlife species considered in this EIS, adhering to the RMFWG would make it impossible to find a 3-month timing window (the least amount of time necessary to drill a 6-8,000 foot well). In addition, virtually all rock reef habitats have known golden eagle or prairie falcon breeding pair or nest site locations.

Most of Area A in Figure 2.7 is occupied Rocky Mountain goat habitat, some portions are big horn sheep range, and some of it includes elk calving and deer fawning areas or functions as migration corridors or transitional range for these species. Much of the area provides summer and fall and designated denning habitat for grizzly bears. Important riparian areas and whitebark pine feeding sites also occur throughout this portion of the EIS area.

Locating human activities a mile east of the reef/or face of the Front (Area B of Figure 2.7) becomes more feasible because conflicts with Rocky Mountain goat, bighorn sheep and the principal raptor breeding habitats (golden eagle and prairie falcon) do not occur.

These areas (A and B of Figure 2.7) do have exceptionally high seasonal wildlife value as spring grizzly bear habitat and elk and mule deer winter range, but a typical fall drilling window (or allowance of other human activity such as pipe laying, road construction) from September to December has been allowable. Some drilling (in the past) in this area has been moved forward or backward in timing depending on whether or not the area was a good fall/berry (Shephardia) feeding site for grizzly bear or a primary mule deer winter range site. If both, strict adherence to three months has prevailed, if not, some leniency over three months has been given.

Locating activities in Area C of Figure 2.7 is less of a problem because spring grizzly habitat and high value ungulate winter range is not prevalent.

APPENDIX G:
Cumulative Effects Model

Activity Coordination Analysis

Because of the abundance and diversity of wildlife populations inhabiting the Rocky Mountain Front and the increased demand for utilizing other natural resources, a method was needed to evaluate the impacts and provide a tool to coordinate management activities with wildlife habitat.

Therefore, an analysis process was developed. Termed "Activity Coordination Analysis", this analysis process utilizes computer technology to overlay and compare maps of suitability for different management activities with habitat maps of various wildlife species to define suitable operating areas and suitable timing windows for management activities under consideration. The computer overlay and comparison process uses the Geographical Information System (GIS) technology to make the necessary comparisons.

Using GIS technology, allows the manager to digitize any type of information that can be mapped and enter it into the computer as an overlay. The computer can then combine various overlays to produce a map of the information desired. By using GIS technology, it is possible to combine large numbers of overlays for a wide range of wildlife species and compare them to terrain suitability for various types of activities.

A GIS system was developed with the following layers (or overlays) as a basis for the analysis.

1. Land ownership and administrative boundaries.

2. Maps of oil and gas leases.

3. Maps of lease stipulation restrictions.

4. Maps of existing management features and activities (roads, trails, outfitter camps, range allotments, timber sales, etc.)

5. A digital terrain model which enables predictive determinations based on slope, elevation, and aspect.

6. Maps of existing seasonal restrictions for various activities which are defined in the Interagency Wildlife Guidelines.

7. Maps of grizzly habitat components within BMU (Bear Management Units).

8. Maps of grizzly protein sources.

9. Maps of landtypes on the Lewis and Clark National Forest.

10. Other layers as needed.

Once the information is entered into the computer the manager can then use GIS technology to compare proposed activities to existing activities and evaluate the positive or negative impacts. The computer can generate maps to display areas that have conflicting, complementary, or no effect of land uses on wildlife habitat.

For most wildlife species the computer analysis will be complete once the physical suitability for the activity the Rocky Mountain Front Interagency Wildlife Guidelines. However, in the case of the threatened grizzly bear, a more sophisticated process will be used. In order to effectively meet goals to recover the grizzly bear population in the Northern Continental Divide Ecosystem and to meet the needs for formal consultation with U.S. Fish and Wildlife Service, the analysis will be carried further using a computer model to predict the cumulative effects of management activities on the grizzly bear. This cumulative effects analysis will be completed on a Bear Management Unit basis.

Cumulative Effects and Analysis

The Cumulative Effects Model (CEM) will draw certain information from the GIS and use that information to make calculations concerning the cumulative effects of management activities on the grizzly bear. The CEM is composed of three submodels which combine to produce the final output. These submodels are: 1) the habitat submodel, 2) the displacement submodel, and 3) the mortality submodel.

The habitat submodel is based on a map of grizzly bear vegetative units generated either by field mapping, mapping an aerial photographs, or digital maps prepared from LANDSAT imagery or other sources. Each vegetative unit was assigned a coefficient between 0 and 1. This rating defines the usefulness of the vegetative unit as both food and cover (separate rating for each) for the spring, summer and fall season of use by grizzly bears.

Adjustments can also be made in food ratings where the particular vegetative unit coincides with bear protein sources (i.e., deer and elk winter ranges, domestic boneyards and winter pastures where there is a source of carrion during the spring). The output of the habitat submodel is a quantitative rating of the Bear Management Unit in terms of bear habitat quality.

The displacement submodel quantifies the effects of displacement associated with human uses or activities on the grizzly bear's ability to use a specific habitat. Interaction of the displacement submodel with the habitat submodel results in an index of habitat effectiveness.

To develop the displacement submodel, human activities and uses which occur along the Rocky Mountain Front were stratified into groups having similar displacement potentials. Each activity group was then assigned a zone of influence (either a given distance or the distance to an intervening ridgeline, whichever came first). Displacement coefficients (0-1) were also assigned to each of the activities

The results of the displacement submodel and the habitat submodel are then merged to develop an index of habitat effectiveness. These changes in habitat effectiveness can be used to display the effects of various management activities or to display changes in effects from changing the timing of an activity (spring habitat effectiveness might increase by scheduling the activity during the summer for example).

The third submodel quantifies the risk of mortality associated with human activities and associated risks of mortality. These are point, linear and dispersed categories similar to those in the displacement submodel. These were then further characterized by the type of use. Each was then assigned a coefficient of 0-1. This coefficient was then modified by the amount of cover in the area. This can then be merged with the other two submodels to provide and overall rating of the cumulative effects on grizzly bears.

APPENDIX H:

HYDROGEN SULFIDE

Hydrogen sulfide gas (H_2S) is a highly toxic gas that has a specific gravity of 1.192 at 60 F (air has a specific gravity of 1 at 60 F). It is a highly reactive gas and will corrode standard metals (the BLM requires the use of H_2S resistant alloys in the drilling and producing of hydrocarbons with associated H_2S). It burns with a blue flame and produces sulfur dioxide (SO_2), also a highly toxic gas. Hydrogen sulfide will disassociate itself from a natural gas stream in which it is mechanically mixed, and will tend to sink in the atmosphere due to its high specific gravity. The gas is, however, wind sensitive, and is readily carried and diluted by winds. The toxicity to humans of H_2S is outlined in Table H-1.

Table H-1: Effects of H_2S Gas on Humans

H_2S (ppm)[1]	0 to 2 minutes	1 to 4 hours
1 to 10	Can smell.	Mild throat irritation, can smell.
20 exposure.	Upper 8-hour safe limit. Can smell. Safe for 5 hours.	Eye stinging, throat irritation. May kill smell.
50	Mild eye, throat irritation; kills smell in 15+ minutes.	Coughing, eye irritation, smell killed.
100	Coughing, irritation of eyes, kills smell in 3 to 15 minutes. Burning of throat.	Coughing, sharp eye pain, throat pain.
200	Kills smell quickly; severe throat and eye irritation; coughing.	Difficulty breathing, sharp eye pain, blurred vision. Cannot smell.

[1]Values over 500 ppm will result in extreme weakness and death.

Source: Adapted from API Recommended Practice No. 59 and Various H_2S Safety Publications.

The risk of hydorgen sulfide blowout is a concern to the residents and users of the area However, the risk of a blowout occurring is minimal, as displayed in Table H-2.

Table H-2: Well Field Blowout Rates

Source	Blowouts Per Wells Drilled	Blowouts Per Producing Well
Texas[1]/ 1 per 270	1 per 20,000	
Alberta, Canada[2]/	1 per 630	1 per 3,000
Gulf of Mexico[3]/	1 per 250	Not given

Note: A blowout is defined as any uncontrolled release of gas to the atmosphere.

[1]/Texas data for years 1977-1981 from David W. Layton, Lawrence Livermore National Laboratory, Livermore, California, October 4, 1982. Blowouts per wells drilled includes dry holes.

[2]/Alberta, Canada, data for years 1970-1980 from David W. Layton, Lawrence Livermore Laboratory, California, October 4, 1982. Blowouts per wells drilled includes dry holes.

[3]/Production of Natural Gas from the Lower Mobile Bay Field, Alabama, Final Environmental Impact Statement, U.S. Army Corps of Engineers, 1982. For Gulf of Mexico data.

In the unlikely event a blowout were to occur, an analysis has been done for this "worst possible situation", such as at the mouth of Blackleaf Canyon (near the present producing wells), coupled with worse case meteorological conditions. The analysis indicates that H_2S concentrations passing by an individual at 2 miles downwind would be slightly less than 2 ppm. H_2S will tend to pool and to accumulate in low areas because of the high density of the gas. If a large uncontrolled blowout were to persist for 12 hours during the worst case meteorological conditions, H_2S concentrations could build to 15 ppm in the drainage bottoms of the EIS area at 2 mile distances downwind and to 50+ ppm at the wellsite.

In the event of such a major blowout, numerous federal regulatory agencies and company officials would be mobilized to evaluate the situation, and the well would be brought under control within several hours. Travel in the area would be restricted during this period. Thus, chances of a large uncontrolled blowout extending to 12 hours is extremely minimal.

If American Petroleum Institute (API) Guidelines are followed during drilling, the chances for a hydrogen sulfide breakout of any magnitude would be minimal. Precautions for drilling in H_2S environments as provided for in draft BLM Onshore Order No. 3, and API-recommended practices, are required for the safety of the drilling rig crew and the general public. These procedures include placement of H_2S monitors at critical locations around the drill rig, set to trigger a visual and an audible alarm if H_2S is detected above a certain level (about 10 ppm). Additional measures include placement of respirators for drillers' use, increasing the mud pH so that any H_2S bound in the mud would disassociate into sulfide and hydrogen ions, and addition of H_2S scavengers to the mud that would form stable compounds when they came in contact with H_2S.

In the event H_2S is encountered, the well could be shut-in with the blowout preventers (BOP), and any additional safety precautions taken to ensure proper control of the H_2S. In the extremely unlikely event of an uncontrolled blowout, the H_2S and natural gas would be flared forming a hot mixture of SO_2 that would readily volatilize and disperse, even in an inversion situation, due to its heat generated buoyancy.

Hydrogen sulfide emissions could also occur from possible pipeline ruptures; however, the risk of a pipeline rupture is extremely small.

An air quality model was used to evaluate the consequences of a gathering line rupture. Because the effects of a gathering line rupture are relatively local and the gathering systems are not in the immediate vicinities of population areas, the consequences analysis could be made in a generic manner, that is, not tied to a specific location for a gathering line rupture. A sensitivity analysis revealed that the predicted concentrations are highly sensitive to the assumptions made about the initial rise of the released gas. The results are also sensitive to variations in block valve spacing (if any), pipeline diameters, pressures, and assumed H_2S content. However, in general, the following conclusions can be drawn:

Low wind speed stable atmospheric conditions result in the worst-case H_2S concentrations. These conditions are estimated to occur less than 10 percent of the time.

A rupture of a 4-inch pipeline is not likely to result in lethal H_2S doses. However, an individual located within about 0.1 mile (600 feet) might experience eye irritation or a loss of smell (discomfort).

A rupture of a 6-inch pipeline could result in lethal doses to persons located within a few hundred feet. People within about 0.5 miles of the rupture could also experience discomfort.

A 12-inch pipe, if ruptured, could cause a lethal dose to a distance of about 0.25 to 1 mile depending on the prevailing weather conditions, specific pipeline design, and H_2S content of the gas.

The Blackleaf Field is anticipated to have 4 to 6-inch lines which, as shown above, would have no fatal impact in the unlikely event a rupture occurred. This, coupled with the area's low level of visitors, indicates that the addition of block valves is not necessary.

APPENDIX I:

LANDTYPE

I. Introduction

This landtype survey of the Blackleaf Unit is designed to describe soils, habitat types, and landforms found on this unit and their suitability for the more commonly applied land management practices.

The mapping unit boundaries were drawn by a reconnaissance survey technique which relies heavily on steroscopic photo interpretations of landform properties such as low order stream spacing and relief. Field mapping was transferred to 1:24,000 scale USGS base maps.

The soils are classified at the family level of the soil taxonomy and representative soil profiles were described using standard soil survey procedures.

Habitat types were classified at all soil description sites. All habitat type nomenclature in this Appendix conforms to that in, "Forest Habitat Types of Montana, 1977" and "Grassland and Shrubland Habitat Types of Western Montana, 1977" published by the Intermountain Forest and Range Experiment Station. Habitat types which could not be classified were related to the most similar habitat types defined.

Mapping units may contain inclusions up to 160 acres in size of lands with management properties contrasting to those described for the unit, and the total area of contrasting inclusions within any delineation may not exceed 15% of the total area within that delineation. Inclusions of lands with similar management properties may occupy up to 50% of any delineation.

The level of reliability and accuracy of this mapping is considered adequate for most land use and functional planning currently being done. The mapping can be used for multiple use plans, transportation plans, timber compartment plans and other similar planning problems. Because of contrasting inclusions, it should not be used for specific projects such as road locations, timber sales and campground without field checking to determine its accuracy.

In the terms of the nomenclature used by the National Cooperative Soil Survey, this is a survey in which the mapping units are prinicipally consociations and associations of phases of soil families.

II. Landtype Identification Legend

Type	Landform	Habitat Type	Soil Class	Slope	Lithology
13A	Glacial Drift Deposits	FESC/FEID POFR/FESC	Typic & Argic Cryoborolls	10-25%	Undiff
14D	Rotational slumps & mud flows	DF/SYAL	Typic Cryochrepts	25-40%	Shale
18	Steep west facing slopes	SCREE	Lithic Cryorthents	40-60%	Limestone
21A	Steep, drift plastered trough walls	AF/LIBO	Andic Cryochrepts	25-40%	Sandstone & Shale
23A	Steep, drift plastered trough walls	DF/SYAL, DF/CARU	Typic Cryoboralfs	25-40%	Sandstone & Shale
23B	Steep upper valley sideslopes	AF/ARCO AF/CAGE	Typic Cryoboralfs	25-40%	Slowly Permeable Limestone
25	Drift plastered trough walls	AF(WBP)VASC AF/XETE	Andic Cryochrepts	40-60%	Sandstone & Shale
25C	Drift plastered trough walls	AF/LUHI MEFE ph.	Andic Cryochrepts	40-60%	Sandstone & Shale
71	Steep glacial trough walls	AF(WBP)VASC AF/XETE	Typic & Andic Cryochrepts	40-60%	Sandstone & Shale
72	Steep upper slopes	FESC/FEID	Typic Cryoborolls, Shallow	40-60%	Sandstone & Shale
161	Low relief ridges & slopes	FESC/FEID PIFL/FEID	Argic Cryoborolls Typic Cryochrepts	10-40%	Sandstone & Shale
161A	Low Relief ridges & low slopes	FESC/FEID ABLA/CLPS	Typic Haploborolls Typic Ustochrepts	1-10%	Sandstone & Shale
161B	Low relief ridges & higher slopes	FESC/FEID ABLA/CLPS	Typic Haploborolls Typic Ustochrepts	2-40%	Sandstone & Shale
171	High relief ridges & slopes	FESC/FEID-AF/XETE	Typis Cryoborolls Andic Cryochrepts	40-60%	Sandstone & Shale
171A	Residual uplands-low relief	FESC/FEID PIFL/FESC	Typic Ustochrepts Typic Haploborolls	25-60%	Sandstone & Shale
181	Glacial cirque headwalls	AF(WBP)/VASC-SCREE	Typic Cryochrepts-rockland	60%+ 60%+	All non-carbonate rocks
182	Very steep glacial breaks	SCREE-DF/JUCO	Rockland-Typic Cryochrepts	60%+	Limestone
183	Very steep peaks-super slopes	SCREE-AF/WBP	Rockland-Typic Cryochrepts	60%	All non-carbonate rocks
200	Well drained floodplain	POTR/FESC-AF/LIBO	Fluvents & Borolls	0-10%	Undifferentiated
201	Wetland	SEDGE-WILLOW	Aquepts & Aquolls	0-10%	Undifferentiated
202	Fault escarpments and glacial cirque basins	Scree	Rockland	60%+	Limestone
204	Low Relief benches fans and terraces	FESC/AGSP	Calcic Cryoborolls Typic Calciborolls	0-8%	Calcareous gravel alluvium
205	Interbedded residual uplands	FESC/FEDI FESC/AGSP	Typic Ustorthents Lithic Haploborolls	10-40%	Sandstone, Shale & Mudstone
206	Footslopes & Fans - low relief	AGSM/DIST	Slickspots - Typic Haploborolls	0-15%	Calcareous sandstone & shale
207	Footslopes, swales & fans	FESC/FEID FESC/AGSP	Pachic Cryoborolls, Typic Haploborolls	2-15%	Calcareous sandstone & shale

III. Landtype Descriptions

13A

Low elevation, nearly level to hilly (0 to 25 percent slopes) glacial drift deposits supporting grassland vegetation. The unit occurs at elevations of 5,000 to 6,000 feet in 15 to 25-inch precipitation zone.

The soils are weakly developed grassland soils with a black loam topsoil 6 to 12 inches thick and brown loam subsoils continuing 35 to 50 percent rounded gravel and cobble. The soils are over 40 inches deep, well drained and are neutral to mildly alkaline in reaction. They contain no restrictions to water movement or root development. Some areas have shallow glacial deposit over shale and sandstone bedrock. Large limestone boulders are in the soil.

Vegetation is dominantly fescue grassland with some included aspen groves and scattered limber pine, Douglas-fir and Juniper on rocky ridge-crests and steep slopes. Habitat types are principally rough fescue/Idaho fescue and shrubby cinquefoil/rough fescue.

The major uses of this unit are grazing and wildlife habitat and there are no serious limitations for these uses. The scattered forested portions are non-commercial forest.

The unit is a major landtype in the Blackleaf Unit in the footslopes of the Rocky Mountain Front.

14D

Moderately steep (25 to 40 percent slopes) landforms formed by slumping supporting Douglas fir forest with some mixture of lodgepole pine or limber pine. Habitat types are predominantly Douglas-fir/snowberry at lower elevations and alpine fir/virgin's bower at higher elevations. Some delineations contain up to 15 percent of fescue grassland parks on rough fescue/Idaho fescue or shrubby cinquefoil/rough fescue habitat types. Areas of this unit along the east slope of the Rockies are in an exposed, windy topographic position and the trees take on a short wind deformed growth form.

The landtype occurs at elevations of 5,000 to 7,000 feet in a 15 to 30-inch precipitation zone.

The soils are weakly developed forest soils with surface layers of litter and duff underlain by brown silt loam or silty clay loam topsoils which form in 4 to 12-inch thick surface layers of wind deposited silt. The subsoil is a grayish-brown or brown clay loam to silty clay containing 50 to 75 percent angular cobble and boulders, usually of limestone bedrock. The soils range from 20 inches to over 60 inches deep and are underlain by clay shale bedrock. They are moderately well drained and seeps or springs are common features. They are mildly to moderately alkaline in reaction and the subsoil is calcareous when limestone is exposed up slope. The underlying shale bedrock restricts water movement and root penetration.

The most serious limitations to use of this landtype are a moderate slump hazard and a relatively warm, dry plant growth environment which may delay forest regeneration. The landtype is a major landtype on the east slopes of the Rocky Mountain Front in the Blackleaf Unit.

18

Moderately steep and steep (15 to 60 percent) west facing slopes which parallel the dip of underlying, highly permeable limestone beds. Weakly dissected landforms. The landform occurs in the glaciated landscapes of the Rockies, and the lower portions of these slopes are sometimes scoured by glaciers. The landtype occurs at elevations of 5,000 to 8,000 feet in a 15 to 30-inch precipitation zone.

The soils are very weakly developed forest soils forming in calcareous loamy material containing 75 to 90 percent flaggy pieces of limestone. They average less than ten inches deep, are excessively drained and moderately alkaline in reaction. There are areas of moderately deep to deep loamy soils over limestone that occur as inclusion in this type.

Vegetation consists of open-growing wind deformed stands of Douglas fir, limber pine and spruce on a scree habitat type. This landtype has very serious limitations to use because of steep slopes and a very droughty, poor quality plant growth environment.

The landtype is of moderate extent on west-facing slopes of limestone reefs in the Blackleaf Unit.

21A

Moderately steep (25-40%) slopes facing north or east. Thin deposits of loamy glacial drift mantling shale and sandstone bedrocks. The landtype occurs at 5,000 to 6,500 feet elevation in a 20 to 30-inch precipitation zone.

The soils are weakly developed forest soils with surface layers of litter and duff underlain by brown loam or silt loam topsoils four to eight inches thick which develop in surface deposits of wind deposited silt. The subsoil is brown clay loam or clay and contains 35 to 50 percent rounded to angular cobble and gravel. The soils average between 20 to 60 inches deep and are underlain by fractured sandstone bedrock. They are well drained and medium acid to neutral in reaction. They contain no restrictions to water movement or root development. Vegetation is mixed Douglas-fir and lodgepole pine forest on alpine fir/twinflower habitat type.

The most serious limitation to use of this unit is in the steepness of slope and shallow soils which limits vehicular travel and productivity on this type. This is a minor landtype in the Blackleaf Unit.

23A

Moderately sloping to steep (8 to 40 percent slope) glacial drift plastered slopes at elevations of 5,000 to 6,000 in a 15 to 25-inch precipitation zone. Vegetation is lodgepole pine or Douglas-fir forest on the drier habitat types in the Douglas-fir series. Major habitat types included are Douglas-fir/snowberry and Douglas-fir/pinegrass.

The soils are moderately developed forest soils with surface layers of litter and duff underlain by dark grayish-brown loam topsoils 6 to 12 inches thick. The subsoil is dark brown clay loam or clay containing 35 to 60 percent rounded gravel and cobble. The soils average between 40 to 60 inches deep and are underlain by frost-fractured sandstone or shale bedrock. The soil is well drained, slightly acid to neutral in reaction and occasionally has calcareous layers in the lower subsoil. It contains no restrictions to water movement or root development.

The most serious limitation to use is the relatively dry plant growth environment which may delay forest regeneration following fire or timber harvest.

The unit is of minor extent in the mountainous portion of the Blackleaf Unit.

23B

Moderately steep (25 to 40 percent) upper valley side slopes underlain by moderately permeable, shaly limestones or calcareous mudstones. The landtype occurs at elevations of 5,400 to 7,000 in a 15 to 25-inch precipitation zone.

Soils are moderately developed forest soils developing in four to eight inch thick surface layers of wind deposited silt overlying weathered bedrock. They have surface layers of litter and duff overlying grayish-brown silt loam topsoils four to eight inches thick. The subsoil is a dark brown, heavy silty clay loam or light silty clay containing 35 to 50 percent angular limestone cobble. The soil is 20 to 40 inches deep, well drained and has neutral reaction in the topsoil and moderately alkaline, calcareous subsoils. The underlying bedrock is slowly permeable to water and restricts root development.

Vegetation is typically mixed lodgepole pine, spruce and Douglas-fir forest on alpine fir/heartleaf arnica, alpine fir/elk sedge or alpine fir/grouse whortleberry habitat types.

The most serious limitation to use is a severe erosion hazard for subsoils exposed on roadcuts.

The unit is of minor extent in the mountainous portion of the Blackleaf Unit.

25

Steep (40 to 60 percent slope) glacially plastered trough walls supporting lodgepole pine forest on lower slopes and grading into mixed lodgepole pine and whitebark pine forest on upper slopes. Fifty to seventy-five percent of the unit is classified as alpine fir (whitebark pine)/grouse whortleberry habitat type occurring on the upper portions of the valley slope and 25 to 50 percent alpine fir/beargrass on the lower slopes. This landtype occurs at elevations of 5,500-6,500 feet in a 20 to 35-inch precipitation zone.

The soils are weakly developed forest soils forming in 4 to 8-inches of wind deposited silt overlying clay loam or clay glacial drift containing 35-50% gravel and cobble. They are deep, well drained, and medium to neutral in reaction. They contain no restrictions to root penetrations or water movement.

The most serious limitations to use are the steep slopes which restrict vehicle operation, avalanche chutes and a severe subalpine climate which delays forest regeneration following fire or timber harvest.

The landtype is of minor extent in the mountainous portion of the Blackleaf Unit.

25C

Steep (40 to 60 percent slopes) glacially plastered trough walls supporting mixed spruce, alpine fir and whitebark pine forest on an alpine fir/woodrush, menziesia phase habitat type. Some alpine fir/menziesia habitat types are included on lower elevation portions of the unit. The landtype occurs at elevations of 5,500 to 6,500 feet in a 20 to 35-inch precipitation zone.

The soils are similar to those described in 25 but differ by having thicker silt loam loess caps which average 12 to 24-inches thick in this unit.

The most serious limitations to use of this unit are a severe mass failure hazard for roadcuts, snowbanks which persist until mid-July in most years, avalanches, and very slow forest regeneration in burns or timber harvest areas.

This landtype is of very minor extent in the mountainous portion of the Blackleaf Unit.

71

Steep (40 t 60 percent) glacial scoured slopes underlain by interbedded sandstones, limestones and shales. The landtype occurs at elevations of 5,200 to 7,000 feet in a 15 to 30-inch precipitation zone.

The soils are weakly developed forest soils forming mostly in weathered bedrock, but surface layers of wind deposited silt occur on north or east-facing slopes. They have surface layers of litter and duff underlain by stony, brown, sandy loam or loam topsoils six to twelve inches thick. The subsoil is a brown sandy loam or clay loam containing 35 to 75 percent angular cobble. The soil ranges from 20 to 40-inches deep, is well drained and medium to slightly acid in reaction. Local areas have slightly or moderately alkaline calcareous subsoils when associated with limestone bedrock. It contains no restrictions to water movement or root development

Vegetation is lodgepole pine forest on lower slopes grading into mixed lodgepole pine, whitebark pine and spruce forest on upper slopes. Habitat types are alpine fir/beargrass (25 to 75 percent) on lower slopes and alpine fir (whitebark pine) grouse whortleberry (50 to 75 percent) on upper slopes.
The most serious limitations to use are steep slopes which restrict vehicle operation and a severe subalpine climate which may delay forest regeneration after fire or timber harvest.

This landtype is of moderate extent in the Blackleaf Unit.

72

Steep (40 to 60 percent) ridge saddles and upper slopes underlain by steeply dipping interbedded sandstones and shales. The landtype occurs at elevations of 5,400 to 7,500 feet in a 15 to 30-inch precipitation zone.

The soils are weakly developed grassland soils forming in weathered bedrock. They have dark brown top soils 4 to 10 inches thick generally underlain by bedrock. They average less than ten inches deep, are excessively drained and slightly acid in reaction. The underlying bedrock restricts water movement and root penetration. The unit commonly includes small areas of barren shale bedrock exposures.

Vegetation is fescue grassland on a rough fescue/Idaho fescue habitat type. Scattered whitebark pine and spruce often occur where fire has been excluded.

The most serious limitations to use are steep slopes, persistent snowbanks and severe soil erosion hazards
The unit is of minor extent and occurs as small, widely scattered areas in the Blackleaf Unit.

161

A complex of fescue grasslands (75%) and mixed limber pine and Douglas fir forest on gently sloping to moderately steep (0-40% slopes) mountain foothills. The underlying bedrock is interbedded sandstones and shales. The unit occurs at elevations of 5,000 to 6,000 feet in a 20 to 30-inch precipitation zone.

The soils are weakly to moderately developed grassland soils with very dark grayish-brown loam topsoils 8 to 16-inches thick underlain by brown loam subsoils containing 35 to 50 percent cobble. The soils are shallow to deep and well drained. They contain no restrictions to water movement or root development.

The forested portion contains stony loamy soils 20-40 inches deep over sandstone bedrock on ridge crests. The dominant texture is loamy in this unit, however narrow stringers of clayey soils occur associated with clayey shale outcrops. In this EIS area, limestone and calcareous shales are dominant in local areas.

Vegetation is fescue grassland on rough fescue/Idaho fescue habitat type. Some rough fescue/bluebunch wheatgrass or big sage/rough fescue habitat types are included on south facing slopes. The forested portion is non-commercial forest land.

The major uses are livestock grazing wildlife habitat and wildlife winter range. The major limitation to livestock grazing is included slopes too steep for primary range.

This landtype is of major extent, occurring widely in the foothills portion of the Blackleaf Unit.

161A

A complex of fescue grasslands (80%) and mixed limber pine and Douglas-fir forest (20%) on undulating to sloping mountain foothills. Slopes are mostly less than 10%. The underlying bedrock is interbedded sandstone, calcareous shales and limestone. The unit occurs at elevations of 4,800 to 6,000 feet in a 15 to 19-inch precipitation zone.

The grassland soils are weakly to moderately developed with very dark grayish-brown loam top soils 8 to 16 inches thick underlain by brown loam subsoils containing 35 to 50 percent cobble. The soils are mainly 20 to 40 inches deep and well drained. The forest soils are weakly developed with surface layers of litter and duff underlain by dark grayish-brown loam topsoils 6 to 16 inches thick. The subsoil is a pale brown loam containing 35 to 75 percent cobble. These soils contain no restrictions to water movement or root development.

Vegetation is mainly fescue grassland on rough fescue/Idaho fescue habitat type. Some rough fescue/bluebunch wheatgrass habitat types are included on south facing slopes. The forest part is dominantly Douglas-fir and lodgepole pine on subalpine fir/virgin's bower, subalpine fir/arnica and subalpine fir/grouse whortleberry dominant habitat types.

The major uses are livestock grazing, wildlife habitat and wildlife winter range. The forested portion is non-commercial forest.

The landtype is of minor extent, but well distributed in the foothills portion of the Blackleaf Unit.

161B

A complex of fescue grassland (80%) and mixed limber pine and Douglas fir forest (20%) on gently sloping to moderately steep (2 to 40% slopes) mountain foothills. The underlying bedrock is interbedded sandstone, calcareous shales and limestone. The unit occurs at elevations of 4,800 to 5,800 feet in a 15 to 19-inch precipitation zone.

The grassland soils are weakly developed with very dark grayish-brown loam topsoils 6 to 8 inches thick underlain by brown loam subsoils containing 35 to 50 percent gravel and cobble. The soils are mainly 20 to 60 inches deep and well drained. The small areas of forest soils are weakly developed with surface layers of litter and duff underlain by dark grayish brown loam topsoils 6 to 10 inches thick. The subsoil is a pale brown loam containing 35 to 75 percent cobble. These soils contain no restrictions to water movement or root development.

Vegetation is mainly fescue grassland on rough fescue/Idaho fescue habitat type. Some rough fescue/bluebunch wheatgrass habitat types are included on south facing slopes. The forest part is dominantly Douglas-fir and lodgepole pine forest on subalpine fir/virgin's bower, subalpine fir/arnica, and subalpine fir/grouse whortleberry habitat types.

The major uses of the unit are grazing and wildlife habitat. There are no serious limitations for these uses.

The unit is of minor extent but well distributed in the foothills portion of the Blackleaf Unit.

<u>171</u>

A complex of lodgepole pine forest (75%) and fescue grassland (25%) on high relief, steep (40 to 60% slopes) glacially scoured slopes underlain by interbedded sandstone and shale. The grasslands occur on shallow soils underlain by shale and the forest on deep soils underlain by sandstone. The unit occurs at elevations of 5,800 to 6,850 feet in the 20 to 35-inch precipitation zone.

The forest soils are weakly developed, forming mostly in weathered bedrock, but surface layers of wind deposited silt occur on north or east-facing slopes. They have surface layers of litter and duff underlain by stony, brown, sandy loam or loam topsoils six to twelve inches thick. The subsoil is a brown sandy loam or clay loam containing 35 to 75 percent angular cobble. The soil ranges from 20 to 40 inches deep, is well drained and medium to slightly acid in reaction. Local areas have slightly or moderately alkaline calcareous subsoils when associated with limestone bedrock. It contains no restrictions to water movement or root development.

The grassland soils are weakly developed, forming in weathered bedrock. They have dark brown topsoils 4 to 10 inches thick generally underlain by bedrock. They average less than ten inches deep, are excessively drained and slightly acid in reaction. The underlying bedrock restricts water movement and root penetration. The unit commonly includes small areas of barren shale bedrock exposures.

The major use is wildlife habitat. The major limitation to timber harvest and grazing is slopes too steep for primary range or the operation of vehicles.

This landtype is of minor extent in the steep mountainous portions of the Blackleaf Unit.

<u>171A</u>

A complex of fescue grassland (80%) and limber pine forest (20%) on moderately steep and steep (25 to 60% slopes) glacially scoured slopes underlain by interbedded sandstone, shale and limestone. The grasslands occur on shallow to deep loam soils underlain by shale and the forest on moderately deep and deep (20 to 60 inches) soils underlain by sandstone and limestone. The unit occurs at elevations of 4,800 to 5,500 feet in the 15 to 19-inch precipitation zone.

The major uses are grazing and wildlife habitat. The forest portion is non-commercial forest.

The soils are weekly developed grassland soils forming in weathered bedrock. They have dark brown topsoils 4 to 10 inches thick generally underlain by bedrock. The soils are well drained to excessively drained and slightly acid to slightly alkaline in reaction. The underlying bedrock restricts water movement and root penetration. The unit commonly includes small area of barren shale exposures. The dominant vegetation is fescue grassland on a rough fescue/Idaho fescue habitat type. The vegetation on the forest portions is dominantly limber pine forest on a limber pine/rough fescue - Idaho fescue phase habitat type.

The most serious limitations to use are steep slopes and soil erosion hazards.

The unit is of minor extent in the foothills portion of the Blackleaf Unit.

<u>181</u>

A complex of stable soils (80%) and rockland and scree (20%) on very steep (60%+ slope) slopes underlain by non-calcareous rocks. The unit occurs at elevations of 6,000 to 7,000 feet in a 20 to 35-inch precipitation zone.

Vegetation is mostly lodgepole pine, whitebark pine or Douglas fir forest. Subalpine fir/grouse whortleberry, blue huckleberry phase, or subalpine fir (whitebark pine)/ grouse whortleberry are the dominant habitat types on stable soils. Forested scree occupies 20% of the landtype.

The stable soils are deep, well drained, neutral to slightly acid soils forming in very gravelly or stony colluvial deposits.

The landtype sometimes supports commercial timber, but timber management is severely limited by steep, broken slopes, avalanche chutes and extensive areas of subalpine fir (whitebark pine)/grouse whortleberry habitat type which is difficult to regenerate following timber harvest.

The landtype is of very minor extent and in the mountainous portion of the Blackleaf Unit.

182

A complex of rock outcrop and talus (75%) and stable soils (25%) on very steep (60%) glacial break slopes underlain by limestone. The unit occurs at elevations of 5,400 to 6,800 feet in a 20 to 35-inch precipitation zone.

Vegetation is principally Douglas-fir, limber pine or ponderosa pine forest on forested scree or Douglas-fir/kinnikinnick or Douglas-fir/common juniper habitat types.

The stable soils are deep, well drained, calcareous soils forming in very gravelly colluvium.

The landtype has value principally as wildlife habitat and some areas provide deer winter range.

The landtype is of moderate extent on the Blackleaf Unit.

183

A complex of rock outcrop and talus (75%) and stable soils (25%) on very steep (60%+) slopes underlain by non-calcareous rocks. The unit occurs at elevations of 5,200 to 6,000 feet in a 20 to 35-inch precipitation zone.

Vegetation is principally lodgepole pine, whitebark pine, spruce and alpine fir forest on forested scree and cool dry habitat types in the alpine fir series.

The landtype has value principally for wildlife habitat and watershed.

The landtype is of minor extent in the Blackleaf Unit.

200

This landtype consists of floodplains and associated terraces and alluvial fans. The unit occurs at elevations of 4,800 to 5,400 feet in a 15 to 25-inch precipitation zone.

Vegetation is variable and ranges from spruce-fir forest to fescue grasslands. Cottonwood and aspen are often included.

The soils form in texturally stratified alluvial deposits. They are deep, well drained or moderately well drained and frequently calcareous. They contain deep, fluctuating water tables which subirrigate shrub and forest vegetation.

The landtype has value for timber production, livestock grazing, wildlife habitat and recreation. It is frequently used as a transportation corridor. The major limitation to use is flood hazard of variable frequency.

The landtype is of major extent and widely distributed along most major drainages in the Blackleaf Unit.

201

This landtype includes wetlands with water tables at or near the soil surface during the growing season. The unit occurs at elevations of 4,800 to 4,900 feet in a 15 to 25-inch precipitation zone.

Vegetation is variable and ranges from spruce forest to willow, bog birch or sedge and tufted hairgrass wet meadows.
The soils are deep, poorly drained and frequently have high organic surface layers.

The landtype has value for watershed and wildlife habitat. The soils are seldom dry enough to support grazing animals without trampling damage to soil and vegetation. Some areas have a flood hazard of variable frequency. Included are small beaver ponds and old stream meanders.

The landtype is of minor extent, but well distributed along major drainages in the Blackleaf Unit.

202

Very steep (60%+) limestone and scree on fault escarpments or glacial cirque headwalls. Active gravitational movement of loose rock and soil are common. On most areas active avalanche chutes are common. The unit occurs at elevations of 6,000 to 8,200 feet in a 15 to 35-inch precipitation zone.

Scree portions of the landtype support open growing stands of Douglas-fir, alpine fir, spruce and whitebark pine on forested scree habitat type. Large portion of the landtype contain bare rock and/or sparse vegetation.

Very steep slopes, barren rock and non-commercial forest preclude economic use of this landtype. However spectacular cliffs with occasional caves make this landtype a dominant visual feature in the landscape.

This landtype is of major extent in the mountainous portion of the Blackleaf Unit.

204

Gently sloping (0 to 8 percent) outwash benches and terraces. The landtype occurs at elevations of 4,800 to 5,200 feet in a 15 to 19-inch precipitation zone.

The soils are weakly developed grassland soils in loam or very cobbly loam materials weathered from interbedded limestone, sandstone and shale. The topsoil is dark grayish-brown loam 8 to 16 inches thick and underlain by pale brown very cobbly loam subsoils. They are deep, well drained soils that have calcareous subsoils with 35 to 50 percent rounded gravel and cobble. There are no restrictions to water movement or root development.

Vegetation is fescue and/or bluebunch wheatgrass grasslands on a rough fescue/Idaho fescue or rough fescue/bluebunch wheatgrass habitat type.

The major uses of the unit are grazing and wildlife habitat. Vehicular travel is common across this landtype due to the gentle slopes.

This landtype is extensive throughout the east half of the Blackleaf Unit.

205

Hilly and steep (15 to 40% slopes), shallow loamy and clayey soils underlain by interbedded shale, siltstone and sandstone. Frequently the faulting is such that the geologic formations are almost tilted on edge. The landtype occurs at elevations of 4,800 to 5,500 in a 15 to 19-inch precipitation zone.

The soils are mainly weakly developed grassland soils with local patches of Douglas-fir and limber pine forest soils. The topsoil is dark grayish-brown loamy or clayey soils 6 to 12 inches underlain by pale brown soils 10 to 24 inches over weathered bedrock in the grassland portion. The forested soils have surface layers of litter and duff underlain by brown or yellowish-brown loam or clay loam 20 to 60 inches deep to bedrock on steep slopes. Ten to 15% of area is nearly barren bedrock exposed along crests of hills. The grassland portion of this unit contains restrictions to water movement and to root development in local areas; however inclusions of deep and moderately deep soils are on lower slopes of hills. Vegetation is fescue grassland on a rough fescue/Idaho fescue or rough fescue/Bluebunch wheatgrass habitat types.

The major uses are grazing and wildlife habitat. The forested portion is non-commercial forest.

The landtype is of minor extent on the Blackleaf Unit.

<u>206</u>

This landtype consists of undulating and moderately sloping (0 o 15% slopes) upland slopes and swales that are wet and saline. The unit occurs at elevations of 4,800 to 5,000 feet in a 15 to 19-inch precipitation zone.

The soils are weakly developed saline-sodic clayey and loamy grassland soils weathered from interbedded calcareous shales and sandstone. The topsoil is dark grayish brown clay loam or loam 4 to 8 inches thick underlain by light brownish gray clayey subsoils. They are moderately deep and deep (200 to 60 inches) somewhat poorly drained soils that are saline and sodic. They are underlain by bedrock.

Vegetation is Inland saltgrass, Western wheatgrass, alkali sacaton, and other native perennial grasses.

The major uses are grazing and wildlife habitat. The major restrictions would be for roads or any kind of development.

The landtype is of very minor extent on the eastern portion of the Blackleaf Unit.

<u>207</u>

Deep loam alluvial deposits on gently sloping to moderately sloping (2 to 15%) fans and sideslopes in the foothill area. The origin of this transported material is from mixed rock sources of igneous rock, sandstone, shale and limestone. The unit occurs at elevations of 4,800 to 5,500 feet in about a 19-inch precipitation zone.

The soils are mainly deep, well drained, weakly developed grassland soils formed in material from mixed rock sources. They have dark gray to black loam topsoils 15 to 27 inches thick.

The subsoil is grayish-brown loam or light clay loam. Sandstone, quartzite or shale bedrock occur at depths of more than 40 inches in some places on upper sideslopes but does not limit vegetation production.

Vegetation is fescue grassland on a rough fescue/Idaho fescue or rough fescue/bluebunch wheatgrass habitat types. Native vegetation is rough fescue, Idaho fescue, bluebunch wheatgrass, Columbia needlegrass, bluegrass, lupine, shrubby cinquefoil, big sagebrush and sagewort.

The major uses are grazing and wildlife habitat. Vehicular travel is common across this landtype due to the gentle slopes. This landtype is of minor extent in the Blackleaf EIS area.

IV. Soil Stability Hazards Table

<u>Use of the Table</u>. Off-site pollution of surface waters is usually the most serious impact of soil erosion. The columns listing these hazards will therefore usually be the most limiting to land use. Deterioration of site quality due to accelerated soil erosion resulting from practices already lowered by mechanical disturbance or compaction from traffic, and the on-site erosion hazards by themselves are seldom limiting to land use. Their importance stems from their interaction with landform sediment delivery efficiency to determine off-site sediment pollution hazards.

<u>Definition of Hazard Ratings</u>

<u>Low</u>: If the hazard exists, it can be overcome with normally used management practices. No special treatment is required.

<u>Moderate</u>: The hazard can be overcome by special measures which are commonly available and economically feasible to apply, but which increase the cost of the use.

<u>Severe</u>: The hazard is difficult and costly to overcome; only land uses of exceptional high value should be considered.

SOIL STABILITY HAZARDS

Soil Land-type	On Site Erosion Hazard — Water Erosion 1/: Compacted topsoils	Road Cuts	Cutback Slumping 2/	Dry Creep 3/	Sediment Delivery Hazard 4/	Off Site Sediment Pollution Hazard — Road Prisms 5/: Construction	Maintenance	Fire 6/	Primitive Roads and Trails 7/	Compaction or Rutting 8/
13A	L	L	L	L	L	L	L	L	L	M
14D	M	L	M	L	L	L	M	L	L	L
18	L	L	L	M	L	L	M	L	L	L
21A	M	L	M	L	L	L	M	L	M	M
23A	L	L	M	L	L	L	M	L	L	L
23B	M	M	M	L	L	M	L	L	M	M
25	M	L	M	L	M	M	M	L	S	S
25C	M	L	S	L	L	L	M	L	L	S
71	L	L	L	L	L	L	L	L	L	M
72	M	L	L	L	L	L	L	L	M	M
161	M	L	L	L	L	L	L	L	M	L
161A	L	L	L	L	L	L	L	L	L	L
161B	L	L	L	L	L	L	L	L	L	L
171	M	L	L	L	L	L	L	L	M	M
171A	M	L	M	L	L	M	M	M	M	M
181	L	L	L	M	L	L	M	M	L	L
182	L	L	L	M	M	L	M	M	L	L
183	L	L	L	M	L	L	M	M	L	L
200	M	L	L	L	L	L	L	L	L	M
201	M	L	L	L	L	L	L	L	L	S
202	L	L	L	S	L	L	L	L	L	L
204	L	L	L	L	L	L	L	L	L	L
205	M	M	M	L	M	M	M	M	M	M
206	M	M	M	L	L	L	M	L	L	S
207	L	L	L	L	L	L	L	L	L	L

Key: L = Low M = Moderate S = Severe

Footnotes:

1/ Water erosion is for soils bare of vegetation and compacted by traffic to the point that infiltration rates are very slow. This condition results from many land management practices such as: roads, skid trails and primitive wheel tracks.

The rating considers only resistance to detachment and movement of exposed soil material and the ease of establishment of erosion control seedlings as it effects the time the soil is susceptible to erosion. It does not consider climatic factors, cover or slope factors which are reduced to a common level by the nature of these practices.

Soils with clayey or loamy textures and more than 35% coarse fragment content in areas with little or no moisture stress to limit erosion control seedlings are rated low. Soils with loamy or clayey texture and less than 35% coarse fragment content in climates with little or no moisture stress to limit the erosion control seedlings were rated moderate. All soils with very sandy texture as well as all soils on dry sites with more than 60 days during the growing season at or below wilting point were rated high.

The roadcut rating assumes the qualities of the subsoil.

2/ Cutbank Slumping is a rating of the hazard of various kinds of gravitational erosional processes occurring. In this area the major processes are mass failure by rotational slumping and mud flows.

The factors used to arrive at the rating are average land slope, thickness of unconsolidated mantle, seeps and springs or other evidence of ground water concentration and lobate flows, slipscars, cracks, leaning trees, and other evidence of mass movement in the geologic past. The ratings are defined as follows:

Low: No evidence of past failure. Residual surfaces with unconsolidated mantles less than six foot thick, and no evidence of ground water concentration or more than 6 foot of unconsolidated mantle on slopes less than 25% with no evidence of ground water concentration or past mass movement.

Moderate: Thick unconsolidated mantles on slopes greater than 25% with low incidence of ground water concentration.

Severe: All slopes with evidence of mass failure in the geologic past and high incidence of ground water concentration.

3/ Dry Creep is a rating of the hazard of gravitational movement of individual soil and rock particles. The process requires steep slopes and exposure of bare soil or rock.

The ratings are defined as follows:

Low: All slopes less than 45% and north or east facing steeper slopes supporting continuous forest vegetation.

Moderate: All south or west facing slopes between 45 and 60% slope whose potential vegetative cover is grass or open growing forest.

Severe: All slopes greater than 60% whose potential vegetative cover is grass or open growing forest.

4/ Sediment Delivery Hazard is a rating of the hazard of eroded material becoming stream sediment. Assumed to be a function of slope and drainage density. The ratings were assigned using the following criteria:

SLOPE SEDIMENT DELIVERY HAZARD

Slope				
60%+	Severe	Severe	Moderate	Low
40-60%	Severe	Moderate	Low	Low
25-40%	Moderate	Moderate	Low	Low
10-25%	Moderate	Low	Low	Low
0-10%	Low	Low	Low	Low
	500-800	800-1200	1200-5000	5000

5/ Road Prisms: Assumes cut and fill construction, drainage installed at proper spacing for grades and soil conditions, seeding of cut and fill slopes, and surfacing of system roads when needed to prevent rutting. The construction hazard evaluates the sediment yield from construction activities and includes water erosion from new cut and fill slopes. The maintenance hazard assumes effective stabilization of water erosion by seeding and drainage. Only the continuing hazard from cutbank mass failures and cutbank ravelling are evaluated.

6/ Fire: Evaluates the sediment hazard from recently burned areas before native vegetation effectively stabilizes the soil. Factors considered are: a) Time required for re-establishment of protective vegetation b) Probability of heat induced water repellency in the topsoil. c) Probability of accelerated slope mass failures due to the loss of the stabilizing effect of plant roots and reduced evapotranspiration rates. d) Probability of accelerated dry soil creep due to removal of the shading effect of the forest canopy.

7/ Primitive Roads and Trails: Logging skid trails, stock trails, system trails and primitive wheel track roads are the major practices evaluated. They all share the common properties of being bare of vegetation, having topsoils compacted by traffic to the point that infiltration and permeability rates are very slow and occurring on variable grades up to about 25 percent maximum. They are often nearly impossible to effectively drain because they are lower than the surrounding land surface.

8/ Soil compaction or Rutting: A rating based on an estimate of the length of time the soil is susceptible to damage from the operation of equipment. The rating considers soil moisture conditions, texture and coarse fragment content. The ratings were assigned using the following criteria:

Severe: Soils susceptible for 8 or more weeks per year. Includes all soils with shallow water tables and all loamy or clayey soils forming in transported sediments with rounded coarse fragments and classified in habitat types as moist as alpine fir/beargrass.

Moderate: Soils susceptible to damage for 4-8 weeks a year. All loamy or clayey residual soils with less than 35% coarse fragments in the topsoil classified in habitat types as moist as Douglas fir/pinegrass.

Low: All other soils.

V. Landtype Suitability Ratings

LIMITATIONS DEFINED

Degree	Kind
I.	No limitation or limitations are effectively overcome by normally used practices. No special treatment required and no added cost.
II.	Limitations can be overcome by special design, location or practices which are commonly available and economically feasible to apply.
III.	Limitations are difficult and/or costly to overcome. Only practices of exceptionally high value should be considered.
IV.	Limitation is so severe that the practice should not normally be considered. Either technology is not available to overcome the limitation or it is extremely economically impractical to apply it.
NA	Not applicable. Little or no potential.

C. Climatic Limitations
1. Plant moisture stress.
2. High elevation, short growing seasons, slow plant succession.
3. Winter snow depth.

T. Travel: Vehicles, animals or people.
1. Steep slopes
2. Rock outcrop
3. Wet ground
4. Broken slopes

S. Soil
1. Shallow, non-rippable hard rock.
2. Water erosion of compacted topsoils.
3. Water erosion of road cutbanks.
4. Slope mass failure.
5. Road cutbank mass failures.
6. Shallow concentrations of groundwater.
7. Cutbank raveling and rock failure.
8. Low subsoil bearing strength.
9. Frost heaving.

O. Other
1. Avalanches
2. Flooding
3. Understory competition for conifer regeneration.
4. Unpalatable vegetation and brushy increaser species.
5. Non-commercial forest.

Landtype Suitability Ratings

Landtype	Logging[1]	Reforestation	Livestock grazing[2]	Game Range[3]	Winter Construction[4]	Road Maintenance[5]
13A	NA	NA	I	II C3	I	I
14D	I	II C1	IV T1	IV C3	II S6	III S5
18	NA	NA	IV T1	IV C3	II S1	II S7
21A	II T1	I	III T1	IV C3	I	III S5
23A	I	II C1	IV T1	II C3	I	II S5
23B	I	I	IV T1	IV C3	II S3	II S8
25	III S4	II C2	IV 04	IV C3	I	III S5
25C	IV S4	II C2	IV 04	IV C3	I	IV S5
71	II T1	II C2	IV T1	IV C3	I	II S7
72	NA	NA	IV T1	IV C3	I	I
161	NA	NA	III T1	II C3	I	I
161A	NA	NA	I	II C3	I	I
161B	NA	NA	II T1	II C3	II T1	I
171	II T1	I	III T1	I	I	I
171A	NA	NA	III T1	I	I	I
181	III T1	II C2	IV T1	IV C3	I	II S7
182	III T1	II C1	IV T1	IV C3	III S1	II S7
183	IV 05	II C2	IV T1	IV C3	IV S1	IV S7
200	I	I	I	IV C3	I	II 02
201	IV T3	I	IV T3	IV C3	IV S6	IV S8
202	NA	NA	NA	IV T1	IV S1	IV 01
204	NA	NA	I	I	I	I
205	NA	NA	II T1	I	III S8	II S8
206	NA	NA	II T3	I	IV S6	IV S8
207	NA	NA	I	I	I	I

Footnotes: Suitability Table

1. Logging: A rating of the limitations to logging by machine or the various moderate to long line cable systems available. It is assumed that cable logging is more expensive than machine skidding and that landtypes on which only cable logging is adapted are less suitable than these on which machine skidding is possible.

   This evaluation also assumes that the logging equipment will operate on the rated landtype and that logging will not be done by cable from adjacent landtypes. Conflicts of logging activity with other values are not considered.

The following limitations were considered.

Slope: Landforms which contain slopes less than 30 percent on more than 50 percent of the area were considered suitable for machines skidding. Others were considered cable logging chances and were given a moderate limitation. Landforms rated for cable logging may contain small areas suitable for machine skidding.

Rock Outcrop: Landforms containing cliffs and talus slopes were given a severe limitation for logging.

Slope Mass Failure: Landforms with a very severe or severe mass failure were considered to have a limitation for logging because removal of the forest canopy increases the risk of slope failure by decreasing evapotranspiration and removing the stabilizing effects of roots.

Wet Ground: Landtypes with shallow water tables on which the operation of logging equipment produces ruts were considered to have a limitation for logging because they require special seeding and erosion control structures to control sediment production from skid trails and landings.

Non-Commercial Forest: Landtypes were considered to have a limitation to reforestation following timber harvest or fire if the probability of achieving full stocking in a clearcut or burn within five years is low. Only limitations such as plant moisture stress, short growing seasons or competition from understory vegetation were considered. Lack of seed source, rodent populations and other similar limitations were not considered. These limitations can be overcome by practices such as shelterwood or selective harvest or by site preparation techniques which are in common useage and they impose a maximum "moderate" limitation to reforestation.

2.Livestock Grazing: Limitation to grazing by brood cows and calves using season-long, rest-rotation or deferred rotation grazing systems are rated. The following criteria were used to rate limitations:

a.Accessibility limitation due to slope: 25 percent slope was considered the maximum slope for primary range. Full utilization of forage on steeper slopes requires special practices such as drift fences.

I: 75 percent of the landtype has slopes less than 25 percent.

II: 50-75 percent of the landtype has slopes less than 25 percent.

III: 25-50 percent of the landtype has slopes less than 25 percent.

IV: Less than 25 percent of the landtype has slopes less than 25 percent; primary range is confined to narrow ridges and valley bottoms.

b.Accessibility limitation due to wet ground: Poorly drained soils on which grazing results in unacceptable trampling damage to soils and vegetation were given a very severe limitation.

c.Limitations related to properties of native plant communities and secondary plant succession:
A moderate limitation was given plant communities containing big sage because of its tendency to increase with grazing use and require mechanical treatment or herbicides to control its spread.

A moderate or severe limitation was given subalpine and alpine meadows because of their susceptibility to long term declines in productivity when overgrazed and the short season of use.

A very severe limitation was given forest understory plant communities in which less than 100 pounds per acre useable forage is produced. The grouse whortleberry and beargrass understory unions are typical of this limitation. Useable forage production does not justify stocking. This limitation was not applied to any plant community on which useable forage production justifies stocking.

The ratings of grazing suitability for forested lands assume the early stages of plant succession following a fire or timber harvest, and no access limitation due to down timber or logging slash.

3. Winter Game Range: The suitability for winter range for elk and deer is rated. The major limitation considered was the accessibility limitation of snow depth to forage availability. Both snow depth and duration of snow cover were considered. Species composition was not considered since these animals tend to use whatever plants are available in the winter. Ratings for forested landtypes assume unstocked or poorly stocked clearcuts or burns.

Very steep or nearly vertical rockland escarpments and cliffs were given a very severe access limitation due to slope.

The following criteria were used to assign suitability ratings for landtypes on which snow depth is limiting.

I: Vegetation is useable every winter except for brief periods after major storms.

II: Vegetation is usable during part of the winter every year and all winter most years. Occasional severe winters force migration to more dependable ranges.

III: Vegetation is useable during the early and late winter period, but game must migrate to more dependable range during the severe part of each winter.

4. Road Construction: Limitations to road construction considered include non-rippable hard rock or subsurface concentrations of groundwater at depths where they are likely to be encountered during construction. Both conditions require special location considerations to avoid the condition or increase expense the of construction activities. The degree of limitation from these conditions is a function of the frequency with which the condition occurs.

Soils with a severe subsoil erosion hazard for road cutbanks were given a moderate limitation because special practices such as temporary seedings of annual grasses or temporary diversion structures are necessary to control sedimentation during and shortly after construction.

5. Road Maintenance: Limitations to maintaining the serviceability of cut and fill construction roads were considered. These ratings do not apply to temporary roads which are used for short periods of time and then returned to production of vegetation.

The limitations considered are:

1. Cutbank slumping: A severe or very severe limitation. The estimated frequency of groundwater concentrations was used as criteria for assigning the different ratings.

2. Cutbank ravelling: Landtypes with slopes so steep that cutbanks cannot be laid back to stable angles were given a moderate limitation due to the added expense of cleaning the debris from the drainage system.

3. Subsoil bearing Strength: Soils with low subsoil bearing strength were given a moderate limitation because they require surfacing to prevent rutting from wet weather travel.

4. Frost Heaving: A limitation imposed by soils with shallow water tables, high silt and clay contents and exposure to freezing temperatures. The limitation is overcome by building a subgrade of freely drained, coarse aggregate. A moderate limitation.

APPENDIX J:

Rare Plants That Could Exist in the EIS Area

This list should not be considered complete, but merely a statement of current knowledge.

Scientific Name/Common Name

Erigeron lackschewitzii Nesom and Weber
Lackschewitz's fleabane

Antennaria pulcherrima (Hook.) Greene
showy pussy-toes

Cypripedium passerinum Richards
bird's egg or Franklin's lady's slipper

Cypripedium calceolus L. var. parviflorum (Sassisb.)
Fern. yellow lady's slipper

Orchis rotundifolia Banks
small roundleaved orchis

Astragalus molybdenus Barneby
Leadville milkvetch

Oxytropis podocarpa Gray
stalked-pod crazywed

Carex maritima
maritime sedge

Carex crawei Dewey
Craw's sedge

Carex livida (Wahl.) Wahl
pale sedge

Gentianopsis macounii (T.H. Holm) Iltis
smaller fringed gentian

Eriophorum viridicarinatum (Engelm.) Fern
green-keeled cottongrass

Juncus acuminatus Michx.
tapered rush

Triglochin concinnum Davy var. debile (Jones) Howell
graceful arrow-grass

Saussurea densa
dwarf saw-wort

Cardamine rupicola (Rydb.) Hitchcock
cliff toothwort

Oxytropis lagopus Nutt. var. conjugens Barneby
rabbit-foot crazy-weed

Appendix K

Chicken Coulee Allotment Management Plan No. 6303

1. Operator: Newman Ranch, Everett Newman

2. Cooperators: Teton Ranger District, Lewis and Clark National Forest; Bureau of Land Management

3. Implementation Date: February 1974

4. Grazing System: 4 pasture rest-rotation

5. Normal Season of Use: July 1 - September 30

6. Operator preference:

   3,822 acres leased (BLM)
   291 active AUMs (BLM)
   112 active AUMs (National Forest)
   341 active AUMs (Private)

7. Livestock Numbers and Class:

   233 cattle (cow-calf operation)

8. Existing Improvements (BLM)

   (1) Clark Spring, T. 25 N., R. 8 W., Section 7: SE1/4NW1/4
   (2) Newman Spring and Pipeline, T. 25 N., R. 8 W., Section 18: NE1/4SW1/4
   (3) Chicken Fence, T. 25 N., R. 8 W., Sections 17, 18, and 19
   (4) Blind Horse Exclosure, T. 25 N., R. 8 W., Section 6: NE1/4SW1/4
   (5) Pamburn Exclosure, T.25 N., R. 8 W., Section 19: SE1/4NW1/4

9. Existing Improvements (USFS)

   (1) North FS Spring, T. 25 N., R. 9 W., Section 1: NW1/4
   (2) Hunter Spring Pipeline, T. 26 N., R. 9 W., Section 36: SE1/4(1/4 mile)
   (3) Hunter Spring Fence, T. 26 N., R. 9 W., Section 36: SE1/4 (1/4 mile)
   (4) Wilson Spring Development, T. 26 N., R. 9 W., Section 36: SW1/4
   (5) Wilson Spring Fence, T. 26 N., R. 9 W., Section 36: SW1/4 (1/4 mile)
   (6) Chicken Coulee Exclosure, Section 17, NW1/4SW1/4, Section 18 NE1/4SE1/4

10. Pasture Rotation System (for 1987):

Pasture	Days Use	Dates
North	30	07/01-07/30
Middle	23	07/31-08/22
South	29	08/23-09/20
Frenchy	0	Rest

The USFS grazes its own horses on two allotments and administers four other allotments that are partially within the Blackleaf EIS area.
Following is a summary of these allotments:

A. Jones Creek Administrative Pasture No. 108

1. Operator: USFS Rocky Mountain Ranger District
2. Cooperator:
3. Allotment Plan Implementation Date: 1975
4. Grazing System: Fall grazing-growing season deferred
5. Normal Season of Use: November 1 - December 31
6. Operator Use: 53 head months (64 AUMs)
7. Livestock Numbers and Class: 26 horses and mules
8. Existing Improvements:

    (1) East Fork Jones Creek Fence No. 101012 (.5 mile)
    Section 34, T. 26 N., R. 9 W.
    (2) Jones Creek Fence No. 101015 (.5 mile)
    Section 15, T.25 N., R. 9 W.
    (3) North Fork Teton Spring No. 110801
    Section 8, T. 25 N., R. 9 W.

B. Blackleaf Administrative Pasture No. 121

1. Operator: USFS Rocky Mountain Ranger District
2. Cooperator:
3. Allotment Plan Implementation Date: 1967
4. Grazing System: Spring grazing-growing season deferred
5. Normal Season of Use: April 10 - June 1
6. Operator Use: 45 head months (54 AUMs)
7. Livestock Numbers and Class: 26 horses and mules
8. Existing Improvements:

    (1) Blackleaf/Muddy Division Fence No. 101002 (.5 mile)
    Section 13, T. 26 N., R. 9 W.
    (2) Blackleaf Wing Gate No. 101001
    Section 13, T. 26 N., R. 9 W.

C. Middle Fork Packer Allotment No. 110

1. Operator: Charles Blixrud, Seven Lazy P Guest Ranch
2. Cooperator:
3. Allotment Plan Implementation Date: 1968
4. Grazing System: Deferred rotation - 2 pastures
5. Normal Season of Use: July 1 - September 6
6. Operator Use: 33 head months (40 AUMs)
7. Livestock Numbers and Class: 15 horses
8. Existing Improvements:

    (1) North Fork Teton Fence No. 101013 (.5 mile)
    Section 23, T. 25 N., R. 9 W.
    (2) North Fork Teton Boundary Fence No. 101014 (.1 mile)
    Section 31, T. 25 N., R. 8 W.
    (3) Upper Clary Coulee Fence No. 101015 (.5 mile)
    Section 13, T. 25 N., R. 9 W.
    (4) Middle Fork Teton Fence No. 101031 (.1 mile)
    Section 27, T. 25 N., R. 9 W.
    (5) Clary Coulee Fence No. 101063 (.3 mile)
    Section 25, T. 25 N., R. 9 W.
    (6) Windy Ford Fence No. 111006 (.1 mile)

Section 26, T. 25 N., R. 9 W.
(7) Clary Coulee Water Development No. 111007
Section 12, T. 25 N., R. 9 W.
9. Pasture Rotation System (for 1987):

Pasture	Days Use	Dates
Teton Park	15	07/01-07/15
Lonesome Ridge	51	07/16-09/16

D. Cow Creek Allotment No. 103
1. Operator: Arrow S. Inc (Tom Selansky) and Lawrence E. and Anne T. Dellwo
2. Administrator: Rocky Mountain Ranger District, Lewis and Clark National Forest
3. Allotment Plan Implementation Date: 1970
4. Grazing System: Continuous, season-long
5. Normal Season of Use: July 1 - September 5
6. Operator Permitted Use:

76 head months (100 AUMs) Dellwo
145 head months (191 AUMs) Arrow S. Inc.
221 head months (291 AUMs) Total

7. Livestock Numbers and Class:

67 cattle (cow/calf) Arrow S. Inc.
35 cattle (cow/calf) Dellwo
102 Total

8. Existing Improvements

(1) Blackleaf Game Range Fence No. 101070 (1.0 mile)
Section 12, T. 26 N., R. 9 W.
(2) Cow Creek Exclosure No. 110302 (.5 mile)
Section 1, T. 26 N., R. 9 W.
(3) Cow Creek Exclosure No. 110303 (.5 mile)
Section 1, T. 26 N., R. 9 W.

E. Dupuyer Creek Allotment No. 105

1. Operator: Boone and Crockett Club
2. Administrator: Rocky Mountain Ranger District, Lewis and Clark Forest
3. Allotment Plan Implementation Date: 1968
4. Grazing System: 3-pasture rest rotation
5. Normal Season of Use: July 1 - September 10
6. Operator Permitted Use: 201 head months (265 AUMs)
7. Livestock Numbers and Class: 86 cattle (cow/calf)
8. Existing Improvements:

(1) Middle Fork Boundary Fence No. 110507 (1.0 mile)
Section 34, T. 27 N., R. 9 W.
(2) North Dupuyer Division Fence No. 101036 (1.2 miles)
Section 27, T. 27 N., R. 9 W.
(3) South Dupuyer Division Fence No. 101042 (1.0 mile)
Section 34, T. 27 N., R. 9 W.
(4) North Dupuyer Spring No. 101068
Section 27, T. 27 N., R. 9 W.
(5) North Fork Dupuyer Fish Exclosure No. 101035 (1.5 miles)
Section 22, T. 27 N., R. 9 W.
(6) Dupuyer Creek Division Fence No. 101007 (.2 mile)
Section 34, T. 27 N., R. 9 W.
(7) South Fork Dupuyer Fence No. 110506 (2.8 miles)
Section 4, T. 26 N., R. 9 W.

9. Pasture Rotation System (for 1987):

Pasture	Days Use	Dates
South Fork	36	07/01-08/05
Middle Fork	36	08/06-09/10
North Fork	0	Rest

F. Scoffin Creek Allotment No. 115

1. Operator: Donald L. Anderson
2. Administrator: Rocky Mountain Ranger District, Lewis and Clark National Forest
3. Allotment Plan Implementation Date: 1968, revised 1971
4. Grazing System : Deferred rotation - 2 pastures
5. Normal Season of Use: July 1 - August 31
6. Operator Permitted Use: 218 head months (287 AUMs)
7. Livestock Numbers and Class: 109 cattle (cow/calf)
8. Existing Improvements:

   (1) Scoffin Creek Pasture Fence No. 101032 (.7 mile)
   Section 9, T. 27 N., R. 9 W.
   (2) Scoffin North Fork Fence No. 101033 (.5 mile)
   Section 21, T. 27 N., R. 9 W.
   (3) Scoffin Boundary Fence No. 1034 (1.0 miles)
   Section 16, T. 27 N., R. 9 W.

9. Pasture Rotation System (for 1987):

Pasture	Days Use	Dates
Scoffin Creek	27	07/01-07/27
North Fork	35	07/28-08/31

APPENDIX L

Biological Evaluation/Biological Opinion
Blackleaf EIS

I. INTRODUCTION

This evaluation is presented as a supplement to the Draft EIS and detailed descriptions of alternatives and other factors put forth in that DEIS will not be extensively duplicated here. Narrative necessary for background in this evaluation will be referenced by page number in the DEIS. The four alternatives to be evaluated are described in Chapter 2, pages 10 to 33. Wildlife values affected are described in Chapter 3, pages 46 to 61, and anticipated effects are given on pages 95 to 118 of Chapter 4.

Generally, the alternatives range from connecting only the five existing wells (2 producing, 2 capable of producing, and 1 to be used as a water injection well) to a gas plant and not allowing any further exploration and development (Alternative I), to fully developing the two defined geological gas structures with a series of eight step-out wells and allowing production on site. Exploration in the area would also continue with six additional wildcat exploration wells. (Alternative II). In between these alternatives from a relative affects standpoint is Alternative III which adheres to the letter the timing windows given in the Rocky Mountain Front Wildlife Guidelines (BLM, et.al. 1987). This would allow only four producing wells, tone injection well, two step outs, and two exploration wells based on ninety day timing windows being the least amount of time necessary to accomplish any kind of drilling project. The preferred Alternative IV allows only two less wells than Alternative II but applies significant mitigation including remote monitoring of well heads during production, which would facilitate minimal human disturbance and stringent road control.

This biological evaluation is prepared in accordance with the Endangered Species Act, Section 7, as amended, and the purpose of this evaluation is to determine if the proposals as put forth in the DEIS "may effect" threatened and endangered species or their habitats whereby jeopardy to their continued existence would be suspected. If BLM makes such a "may effect" determination it must formally present this biological evaluation to the Fish and Wildlife Service (FWS) for their biological opinion as to jeopardy. If the FWS determines jeopardy exists for a species, the proposal will not be allowed to go forth unless it can be modified to non-jeopardy status.

Biological evaluations of the affects of man's activities proposed on the RMF, most concerning oil and gas exploration in the EIS area, have been submitted for consultation previously. A biological evaluation was prepared for the Headwaters Resource Management Plan/EIS in 1983. This RMP discussed oil and gas leasing along the RMF including necessary stipulations (time and space restrictions) to protect important habitats. Since that time, four assessments for exploratory wells in the Blackleaf EIS area have been prepared and submitted. Each assessment has built on our understanding of how best to evaluate effects from these projects and how to design them to least affect wildlife.

The FWS has indicated that threatened and endangered species that must be considered on the Rocky Mountain Front are bald eagle, peregrine falcon, gray wolf, and grizzly bear. Limited discussion has already been provided on these species and their habitats on pages 56 thru 61 in Chapter 3 of the DEIS.

No rare or endangered plants are listed for this area and no additional plants or animals are proposed for listing.

Documented occurrence, abundance, relative importance of habitats, and other pertinent factors have been described in the numerous studies undertaken through the RMF Task Force effort which resulted in publication of the Interagency RMF Wildlife Guidelines (BLM, et.al. 1987) Summaries of the findings of this research as it relates to the four threatened and endangered species follows complete with a determination of "effect" from the activities proposed by a full field gas development program.

II. SPECIES OCCURRENCE/DETERMINATION OF EFFECT

Bald Eagle
Haliaectus leucocephalus

Dubois, 1984, intensively surveyed raptors along the RMF and found no nesting bald eagles. She documented a historic nest site from the pre-1950 period along the Sun River and also indicated that the Teton River was suitable as nesting habitat, however, it was her determination that no other drainages appeared to be suitable for nesting bald eagles. The Blackleaf EIS area is in the latter category.

Bald eagles are present on the RMF from September through April as añ uncommon winter resident and migrant. Observations of eagles are most likely to be made south and east of the EIS area where fisheries and open water are more prevalent. Some wintering habitat was delineated in the Antelope Butte Swamp locale (Figure 3.10 in Chapter 3,DEIS).

A "no effect" determination is made for all Alternatives as nothing proposed for oil and gas exploration or development would be expected to occur in area bald eagles would frequent during the breeding season. If the unlikely occurrence of nesting activity by a pair of bald eagles wasever documented in the Blackleaf EIS or anywhere on the RMF, it would trigger a series of protective measures. BLM and other Task Force members would adhere to the RMF Guidelines, which would alleviate any "effect" possibilities. This would include preventing human visitation or other disturbing activities within influence zones of an active nest territory.

Peregrine Falcon
Falco peregrinus

Suitable, but presently unoccupied, peregrine falcon habitat occurs along the RMF, and the Front has been proposed as a possible reintroduction area. Occasional observations of adult peregrines have been made during the spring and fall. These peregrines are assumed to be migrants.

DuBois (1984) clasified cliff habitats thought to be most suitable for peregrines (Figure 3.10 in Chapter 3 of this DEIS). Characteristics she used were cliffs close to extensive riparian habitat (within five kilometers), over 50 meters in height and one kilometer in extent, with numerous nesting ledges, and the majority of the cliffs under 2,300 meters in elevation. Potential nesting areas meeting these criteria are shown on Figure 3.10.

A "no effect" determination for all alternatives is made for the peregrine for the same reason given for bald eagle (adherence to the RMF Guidelines).

Gray Wolf
Canis lupis

Habitat requirements for gray wolf are evident along the RMF, an area of extensive prey specie winter/spring ranges backed by the expansive Bob Marshall Wilderness Area. Wolf occurrence information on the RMF has been collected by the Wolf Ecology Project, University of Montana (Mattson and Ream 1978). Of 90 wolf occurence reports recorded on the RMF including Glacier National Park east of teh Continental Divide during the last decade (1978-88 U.S. Fish and Wildlife Service files), 60 percent have occurred within the last three years, and virtually all of these were in Glacier County. This was due to a group of wolves dispersing from the "magic park" which had become established on teh west side of the continental divide (Robbins, J., 1986, Ream, et.al. 1975, Ream 1985). This would indicate that occupation by a pack of wolves along the RMF within or near the EIS area is certainly likely in the near future. Ten of the 90 wolf occurrence reports were in the Teton County where the EIS study area lies, but these were all made from 1978 to

Overcoming livestock/wolf conflicts may become the most limiting factor in wolf re-establishment on the east side of the Continental Divide as evidenced by the recent control effort necessary to prevent further depravation of livestock on the east side by wolves that had dispersed from the magic pack. If this particular group of wolves had traveled further south than the Blackfoot Indian Reservation, an area of relatively low big-game numbers, and taken up residence on the Blackleaf EIS area where wild prey is more abundant, their fate may not have been as disastrous. Thus, maintenance of prey species habitats could prove to be very important in meeting wolf recovery goals in the future as outlined in the revised Northern Rocky Mountain Wolf Recovery Plan (Fish and Wildlife Service, 1987).

This plan describes key components of wolf habitat as abundance of natural prey and minimal exposure to humans. Increased exploration and development of natural gas resources in the Blackleaf EIS area could possibly decrease the value of prey base habitat in the area and increase human activity, thus negatively effecting key components.

The acres of ungulate prey species winter range habitat that would be within a 1-mile zone of influence from drill sites or producing wells and size of big game herd unit located within and adjacent to the EIS area are given in Table L-1.

Table L-1

Alternatives

Species	1	2	3	4	Maximum 1> Estimated Herd Size
Rocky Mountain Goat	2050	8390	2050	7680	113
Bighorn Sheep	530		430	105	
Elk	12060	33810	17810	35820	325
Mule Deer	5410	15600	13150	17680	2600

1> Data taken from the DEIS, pages 48 to 52 in Chapter 3 of this DEIS.

The principal prey in the area is mule deer. Herd units and descriptions of population parameters including densities that are found in the EIS area are discussed on page 48 of Chapter 3 in this DEIS. Of the four mule deer herds mentioned, the northern half of the Blackleaf-Teton herd consisting of 4-500 deer would be most effected. Industry activity as proposed will, for the most part, occur south of the designated high density winter range for the other three herds. Also, a healthy whitetail deer population occupies the Antelope Butte Swamp and could contribute significantly as prey for gray wolf. The swamp is centrally located to gas field activities.

Negative consequences that can be expected from oil and gas activity on wildlife, including ungulate prey species in general, were described on pages 95 to 118 in Chapter 4, of this DEIS as summarized by Bromley, 1985. Important prey species habitats that would be negatively effected by particular well sites is given on Tables 4.17 through 4.20 and shown on Figure 4.1 through 4.4 and their associated tables in Chapter 4 of the DEIS. Either elk or deer winter range or both occur at each site proposed, thus, whatever negative trends in population that might result from field development could be reflected in a reduction of prey base and an indirect negative effect on gray wolf.

Increased human activity in the EIS area for whatever reason, especially during the winter season, also increases the likelihood of the killing of a wolf, either by mistake or purposefully.

Obviously, a number of methods can be employed to reduce the chances of these negative effects occurring. Firearms should not be allowed on the job or in vehicles that transport workers to any job site. Industry officials should caution employees concerning strict enforcement and severe consequences of firearms violations, including loss of employment. In addition, employees should be made aware of the consequences under ESA should they shoot a wolf or other T & E species; bald eagle or grizzly bear. All roads in the Blackleaf field development area that are non-essential should be closed to traffic, and all other roads should be locked and only opened when necessary. Remote monitoring of wells with gas processing occurring at a central point will greatly aid in development of a road management plan conducive to prevention of an illegal shooting.

All of the above concepts for lessening effects plus additional measures are given in the RMF Wildlife Guidelines. General management guidelines for all species and specie specific guidelines for deer and elk are those most applicable as management methods to alleviate or lessen impacts to wolves. BLM and other particpating agencies are committed to applying all of these guidelines when permitting any human activity on the RMF. Some minimal lengthening of timing window and adjustment of timing window based on on-site evaluation for particular well sites was discussed in the DEIS for the preferred alternative, but overall effects of these changes would be negligible to the gray wolf, and possibly will lessen impact on high density mule deer winter range. If additional unforeseeable deviations from guidelines arise from site-specific inspections as development progressess, additional NEPA and ESA compliance and consultation will be required.

Considering that the above guidelines will be incorporated into any project to the highest degree possible, effects on gray wolf will be relative to the scope of the project and the success of applying the RMFWG. It is therefore obvious that Alternative 1 would have the least effect on gray wolf because of the few wells considered and production at a central facility with remote monitoring of wellheads. Alternative 2 would have the most effects because of the higher number of wells and production allowed on site. Production on site greatly increases road use throughout the life of a well and complicates good road management, the key to lessening negative consequences. Alternatives 2 and 4 employ remote monitoring, but Alternative 3 is less negative as it has fewer sites. Alternative 4 (the preferred alternative) incorporates all of the best mitigation possible but could still affect wolves because of the number of wells programmed and the effects from production which cannot be avoided by application of timing stipulations.

In summary, both direct (illegal killing) and indirect (loss of prey base) effects are possible for the gray wolf for any of the four alternatives considered. The degree of effect is relative to the number of sites allowed and the mitigation applied. Full field development "**may effect**" gray wolf recovery, and therefore, BLM is formally requesting FWS's opinion as to jeopardy.

Grizzly Bear
Ursus arctos horribilis

Under the direction of the Interagency Grizzly Bear Committee (IGBC) all federal surface lands in the Northern Continental Divide Ecosystem (NCDE) were stratified as defined in the Guidelines (51FR42853). Private lands were not classified as such but could contain equally valuable habitat for bears. Most of the Rocky Mountain Front (RMF) is classified as Management Situation I (MS-I) habitat which indicates area that contains grizzly bear population centers and habitat components needed for the survival and recovery of the species or a segment of its population. Management direction for MS-I lands is to give priority to maintenance and improvement of grizzly habitat. The Blackleaf EIS area is totally classified as MS-I except for a very small portion (about 1%) at the southernmost boundary along the Teton River Road near human habitation which is classified as MS III. Management direction there is to discourage grizzly bear presence and minimize grizzly-human conflicts.

The RMF grizzly bear population has been intensively studied (Jonkel, 1976 and 1977, Schallenberger, 1974 and 1976, Sumner and Craighead, 1973, Hamlin and Frisina, 1974, Schallenberger and Jonkel 1978, 1979 and 1980, and Aune and Stivers, 1981-1986). The most recent efforts from 1981 to the present, supported by joint funding of the Interagency RMF Task Force and under the direction of principal investigator Keith Aune, have used the aid of radioed bears and telemetry. Aune has gathered information on distribution, home range, use of habitat by season, food habits, population biology, density estimates, mortality, and other factors including effects on bears from oil and gas activity. Aune's expertise and data were used to formulate the grizzly bear portion of the RMF Wildlife Guidelines (BLM et.al., 1987), which are being distributed with the DEIS.

Concurrent to Aune's efforts, a process was being developed to analyze cumulative effects of human activities on grizzly bears and their habitats. Cumulative effects are defined as **"The combined effect upon a species or its habitat caused by the current program plus a proposed activity, as well as other reasonably foreseeable events which are likely to have similar effects upon that species or its habitat. Cumulative effects can result from individually minor but collectively significant events taking place over a period of time."** Computer science was enlisted to store and manipulate the large amounts of data necessary to calculate cumulative effects and the process was labeled the Cumulative Effects Model (CEM)(Godtel, 1987).

The CEM was designed to provide resource managers an analytical tool for evaluating existing as well as potential habitat effectiveness levels and mortality risk relative to a proposed activity. The analysis will be quantifiable for a defined area which is small enough so that the data base can be processed yet large enough so that it is biological meaningful for evaluating survival implications to grizzly bears. That area is called the Bear Management Unit (BMU).

BMU's contain sufficient constituent elements and effective habitat to meet a subpopulation goal for adult female grizzly bears. The Blackleaf EIS area of 91 square miles lies within the boundaries of the 322 square mile Birch-Teton BMU. Determinations of one bear per 18 square miles with two breeding age females with young have been made for this BMU (Dood etal, 1986). This results in an estimated population of 18 bears.

Spring, following den emergence, is the most critical time of the year for grizzly bears. Aune, 1987, gave emergent dates ranging between March 10 and May 13 with a median date of April 10. Much of the Birch-Teton BMU is spring habitat (Figure L-1) and the Blackleaf EIS area has been shown to be of high value as spring range (Figure L-2).

Aune's data shows the importance of river valley, creek bottom, and foothills habitat to grizzly bears in the spring. Others, (Schallenberger and Jonkel (1980), Servheen (1981), and Jonkel (1980)) recognized the importance of low elevation wet sites and creek bottoms to grizzly bears in the spring. Bears concentrate on these areas because of early snow melt from these sites and the phenology of important bear foods. On the RMF, bone yards located at low elevations also draw bears down to the foothills and flatlands at this critical time.

Bears distribute themselves more evenly throughout the BMU during summer and fall (Figures L-3 and L-4) but still make significant use of the EIS area because of the preferred habitat features found in Antelope Butte Swamp and other riparians. Also, as buffalo berry (Shepherdia canadensis) berries ripen in the understories of Limber pine and other berries such as chokecherry (Prunus virginiana) do likewise in riparians bears are drawn into the habitats represented in the EIS area.

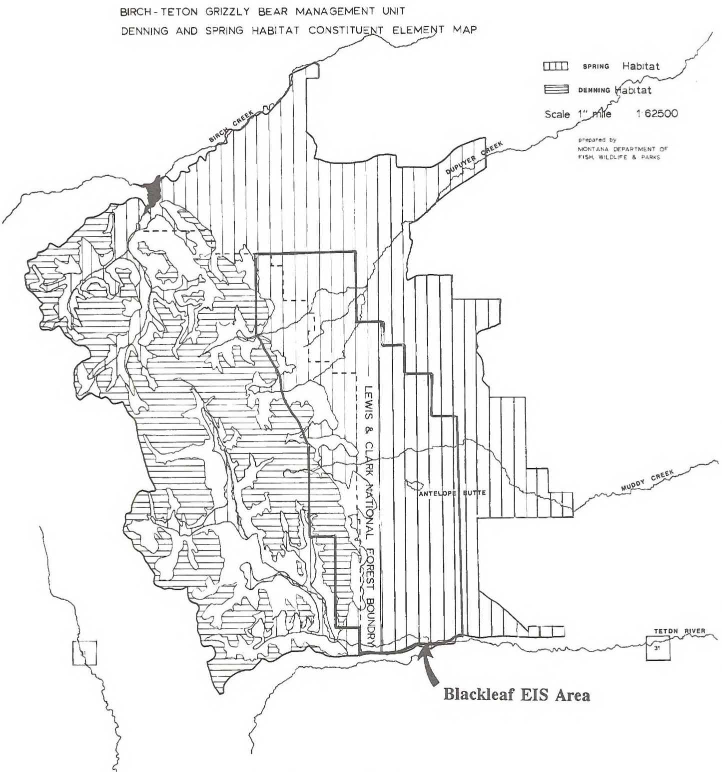
The western, higher elevation portions of the BMU are denning habitat but very little of this would be influenced by any alternative of the EIS as shown in Tables 4.17 through 4.20, in Chapter 4 of the DEIS. The median date for den entry as reported by Aune, 1987 was November 8.

Maintaining habitat and security for breeding age females is recognized as the key to continued grizzly bear survival in a given BMU. During Aune's studies, home range data was secured in the Birch-Teton BMU for three breeding-age females. The areas used by these females were closely aligned to Antelope Butte Swamp and Volcanoe Reef which are areas of principal interest for gas field development (Figures L-5, L-6, and L-7).

Female grizzly bears are **"tied to a piece of real estate"** (Personnel Communication, Keith Aune, January 1989); or in other words, display a high degree of fidelity to a particular area which would be represented by home range boundaries. Also, grizzly bear young are highly likely to follow in mother's footsteps and show the same fidelity to almost the same area. Thus, the Antelope Butte Swamp and Volcanoe Reef areas which were documented as being so important to the three females listed above are likely to be of similar importance to future breeding age females in the BMU.

Roads are an integral part of the development of a gas field. Less use of habitats within 100 meters of roads in Canada has been documented (McLellan, B.N., and Shackleton, D.M., 1988). Some loss of special habitat will, therefore, occur as the field develops, but of more immediate importance, any increase in access, especially uncontrolled, increases the likelihood of man, firearms, and grizzly bears coming together at the same time and place. As indicated by study findings, **"Most female mortality has been within 1 Km. of a road in the RMF study area"**, (Keith Aune, Personnel Communication, January, 1989). The first study mentioned in this paragraph also indicated increased vulnerability of grizzlies to both legal and illegal killing because of access. **"All known and suspected adult and sub-adult grizzly deaths (n=29) since 1979 have been due to legal or illegal hunting; most bears were shot from roads"**. Most other research shows similar conclusions concerning coorelation between grqzzly bear nortality and roads (National Wildlife Federation, 1987, and Dood et.al., 1986).

Figure L-1 Birch Teton Grizzly Bear Management Unit.



Source: Aune, K. and B. Brannon, 1987.

Figure L-2 Distribution of Spring Grizzly Bear Observations.

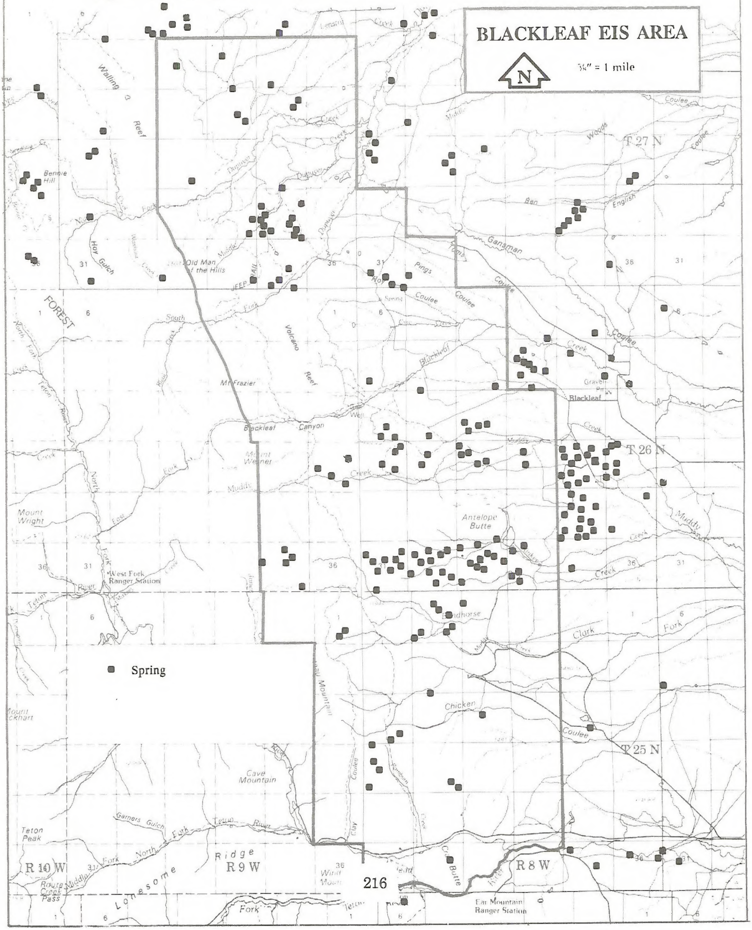


Figure L-3 Distribution of Summer Grizzly Bear Observations.

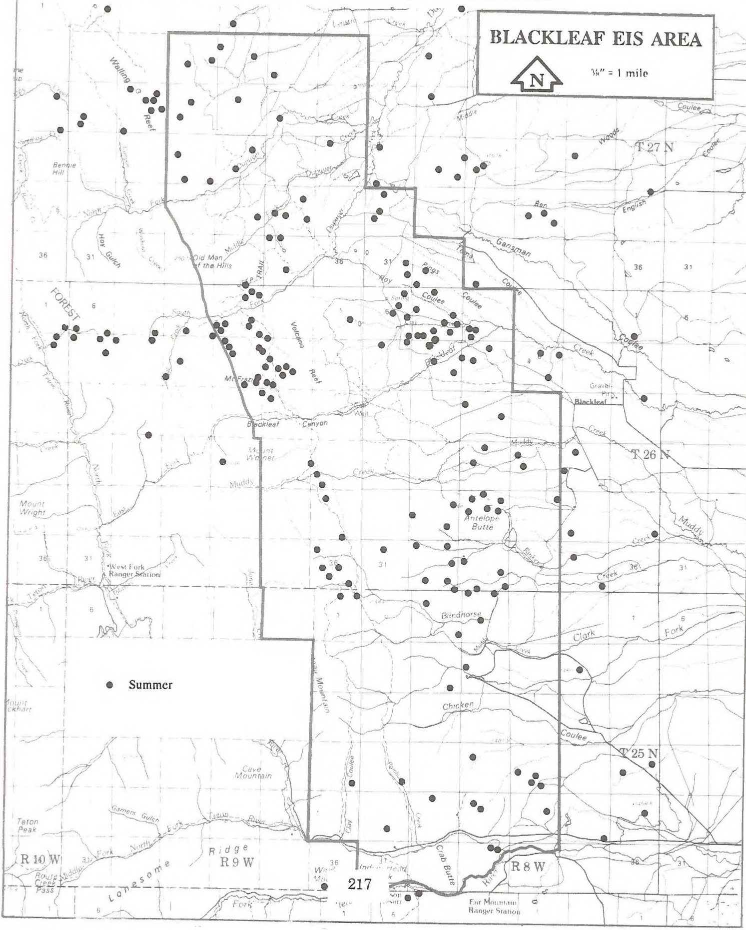


Figure L-4 Distribution of Fall Grizzly Bear Observations.

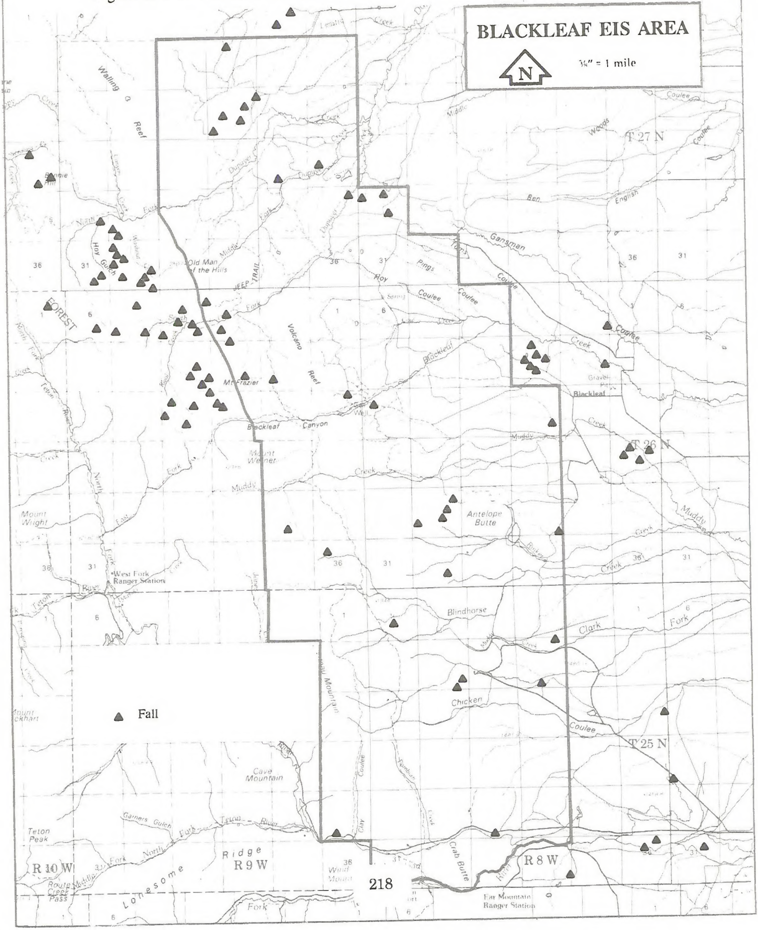
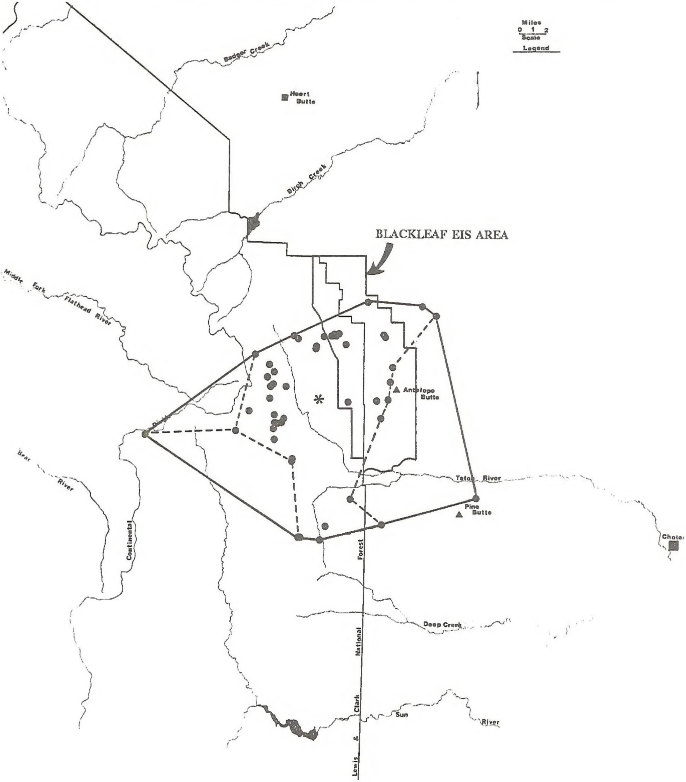
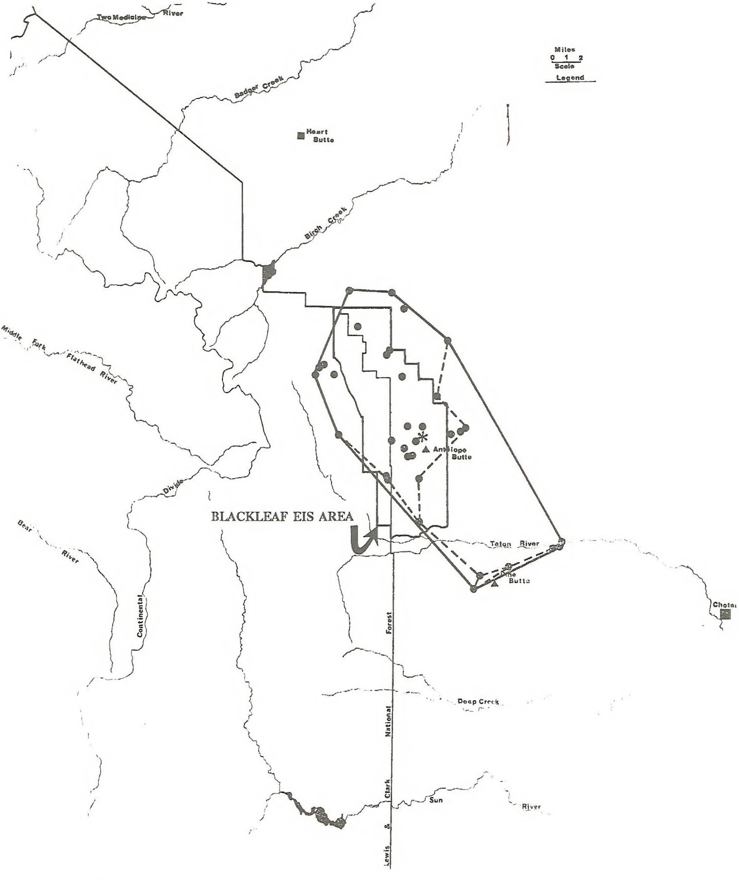


Figure L-5 Minimum and Modified Minimum Home Range of Grizzly 220, 1983.



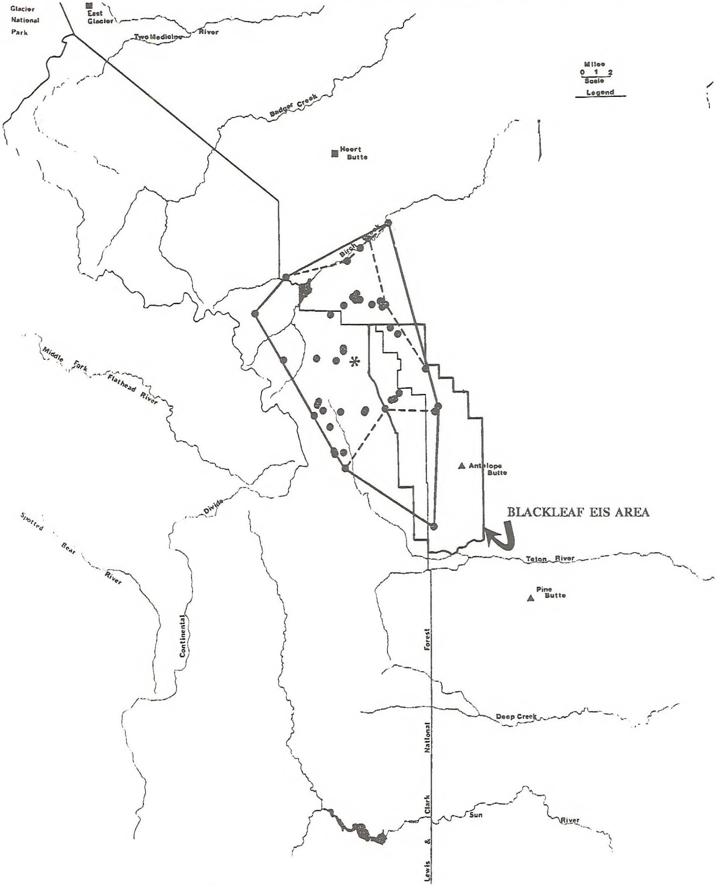
Source: Aune, et.al., 1984.

Figure L-6 Minimum and Modified Minimum Home Range of Grizzly 257, 1983.



Source: Aune, et.al., 1984.

Figure L-7 Minimum and Modified Minimum Home Range of Grizzly 335, 1983.



Source: Aune, et.al., 1984.

CUMULATIVE EFFECTS MODEL (CEM)

Because the analysis of full field development in such important wildlife habitat was so complex and controversial, and because the principal tool to display effects on grizzly bear involved a new process, cumulative effects computer modeling (CEM), early involvement and discussions were initiated with not only the U. S. Fish and Wildlife Service but also with the Montana Department of Fish, Wildlife, and Parks. Advice and professional opinion from biologists from these agencies as well as the US Forest Service aided in development and selection of the preferred alternative, and their opinions were supported by CEM outputs.

The reviewer is referred to the USFS publication on "Cumulative Effects Analysis Process for the RMF Northern Continental Divide Grizzly Bear Ecosystem" (U.S.Forest Service, 1987) for descriptions of the complicated modeling processes and formulas used in the computer assisted analysis. The basic geographic unit of the CEM is the vegetation polygon (individually delineated units of vegetation). The model results calculates values based on the inherent habitat values of polygons as affected by various human activities. The CEM is composed of two phases: (1) data base construction phase; and (2) the analysis phase. Within the data base construction phase there are two submodels that develop the data base; habitat, and activity. The habitat submodel uses data variables (food, cover, edge value etc.) to arrive at seasonal habitat values for the subunit. The activity submodel creates zones of influence for each activity based on nature and type of activity, disturbance coefficients (DC), cover-noncover relationships and determines the habitat values for the vegetative units within the zone-of-influence. The analysis phase uses results from the data base construction phase as data for formulas that calculate the model results; habitat effectiveness (HE) and mortality risk index, (MRI).

During analysis, each well site and associated road and pipeline systems were separately run through the CEM, and outputs for changes from the existing situation in HE and MRI were obtained for each season (Tables L-2,L-3 and L-4). These data were correlated with information available from Keith Aune's study, and the interagency group decided on the relative importance to grizzly bear and acceptability of each well site and road system in formulation of the preferred alternative. Other factors were discussed including relative impacts to all wildlife species and the significance of the site to recovery of gas reserves as the field developed, but the judgement as to how the grizzly bear would be affected from development of that site was the decisive factor as to whether or not a well site, road, or pipeline location should be included, modified, or dropped.

As a result of these Interagency discussions, review of Aune's study data, and CEM analysis, the following changes were made to the sites proposed in Alternative 2 to formulate the preferred Alternative 4:

1. Two wells, S-6 and S-7, located at the head of Cow Creek and underneath Volcano Reef were dropped in the preferred Alternative. This particular area was considered crucial to grizzly bear and has been central to activities of breeding-age sows, (Figures L-5, L-6, and L-7). The area also has a multitude of other important wildlife values. Accessing these two sites while holding impacts to an acceptable level was not considered possible.

2. A new road design to access S-8 by skirting around the Cow Creek area was made. This was done in order to keep man's influence on grizzly bear habitat in the Cow Creek/Volcano Reef area to a minimum.

3. The S-4 site and associated road and pipeline on the south side of Muddy Creek were relocated to lessen impacts. The pipeline was totally redesigned and will now follow the new roadway rather than opening a new path through important grizzly bear bedding cover and riparian to the east of the well site.

4. The S-2 site was extremely difficult to design to a minimal and acceptable level of negative influence on grizzly bear. It is located within a highly used grizzly bear complex just upslope (1/4 to 1/2 mile) of the Blindhorse and Rinkers Creek riparian areas. The well site is in an extremely dense limber pine-juniper habitat component which is principally used for bedding after bears have been feeding in the riparian.

Originally, the road to S-2 was designed to come from the county road almost due east and climb up through the Blindhorse/Rinkers Creek riparian areas. Upon initial analysis it was agreed that such a road and well site location would be extremely detrimental to grizzly bears in the Blackleaf/Teton BMU; and that if a road could be designed to come off of an existing road to the south (which had been upgraded for a drilling project in 1985), and that S-2 could be moved westward to get further away from the riparians the level of negativity would be significantly reduced.

Thus two road routes were so designed, one high thru the Blindhorse Outstanding Natural Area and one lower which switchbacks through the upper portion of Blindhorse Creek. Each leads to a separate S-2 well site, and both sites are west of the original S-2 in Alternative 2. The group felt that without a doubt the lower route was less impacting than the upper, but still located in a critical area. Concern was expressed about the pipeline route should the well be a discovery. It was felt that a pipeline lane through such heavy cover would be detrimental as it would entice people to use it as a travel lane. Consequently, the pipeline was designed to travel down the well road until it gets close to grassland prairie near Rinkers Creek and then cut through cover for only about a 1/4 mile onto the grassland.

In the future, as the CEM is refined and validity and sensitivity tests are performed on it, its utility as a tool of analysis and aid in helping make management decisions will become more meaningful. At this point in time, it is most useful as a comparative tool; comparing one road route to another, one well site to another, combinations of activities compared to other combinations, or one complete alternative to another. It is in this context that we have structured the following analysis.

INDIVIDUAL WELL ANALYSIS

Tables L-2, L-3, and L-4 list the outputs for the exploration of each proposed well including associated roads for each season as if no time and space requirements were applied to the site and no activities other than that particular well site were to be added to the activities already existing in the BMU. Some wells have more than one analysis because they were calculated with different road routes, mostly due to alternative formulation (Tables L-2, L-3, and L-4), as previously explained. The data tabled, show which wells would influence the most important grizzly bear habitats and how much the HE would be lowered and the MRI raised.

Two factors provide a relative index of the effects of a particular well site on grizzly bear habitat; one related to quantity and one related to quality. The acres of habitat within the zone of influence (ZI) of a particular project indicate the amount of habitat affected, and the seasonal habitat value (SHV) of these acres is an index to the habitats quality.

Acres of spring habitat that would lie within the zone expected to be negatively influenced by activities necessary to explore each well ranged from 6,060 acres for E-1 to 12,645 acres for S-7 with a northerly access route (Table L-2). Most wells influence about 9-10,000 acres of habitat. Aune, 1987, mapped spring habitat in the Teton-Birch Creek BMU (FigureL-1) and determined that over 80% of this element lay outside of the National Forest. Slightly less than 60% of the BMU was classified as spring habitat, yet influence zones for all sites are almost totally spring range (Tables 4.17 through 4.20 and Figures 4.1 through 4.4 of the DEIS.).

According to Aune, 1987, the BMU contains 512.1km^2 (126,080 acres) of spring habitat. As previously mentioned, the typical well in this gas field would influence about 9-10,000 acres of spring habitat. Comparing Aune's spring range map to computer outputs would indicate that exploration and production activities associated with field development for the average well site, if not mitigated by timing windows or other measures, would negatively affect 7 to 8 % of the grizzlies spring range.

If the activity associated with each well were to be permitted during the spring, the change in HE for the acres influenced would decrease in a range from 1.96% at E-1 to 6.18% at E-6. Generally, however, adding a well site to the BMU reduces the HE in the Zone of Influence (ZI) by about 4%. If exploration activity were to be undertaken during the summer or fall periods, the reduction in habitat effectiveness levels would range from 1.52 to 4.15 and 1.57 to 4.42, respectively. These numbers are not as large as the reductions in spring, but the HE levels for the existing situation are significantly less than those for the spring period (Table L-2), and the area qualifying as summer and fall range is more expansive.

Seasonal Habitat Values (SHV's) for the acres in the ZI in spring ranged from 0.5888 at E-3 to 1.095 at E-4. Most step-out wells exhibited SHV's of around 0.8. It is apparent that as a general rule grizzly bear habitat affected by proposed sites at the southern end of the EIS area was not as high value as that in the middle and northern end.

This individual well analysis was most important in comparing level of impact from one well to another by season and for alternative formulation, but at this stage of model use and development the interpretation of the magnitude of the number changes are difficult to relate to. Since roads and possibly pipelines are to be shared in full field development, operations are staggered over long periods of time, and mitigation including time and space restrictions and remote monitoring are to be applied, the magnitude of the numbers expressed in this individual well analysis are exaggerated.

Table L-2. Comparison of Cumulative Effects Model Outputs for each well site as if activities occured during SPRING.

WELL SITE	HABITAL VALUE(HV)	REDUCTION IN HV	ACRES IN THE ZONE OF INFLUENCE (ZI)	SEASONAL HABITAT VALUE (SHV) IN ZI	% REDUCTION IN HABITAT EFFECTIVENESS (HE)	MORTALITY RISK INDEX (MRI)
B-1	5,667	4,210	10,445	0.543	3.78	.00614
S-1	4,272	3,284	7,870	0.543	2.91	.00420
S-2	3,877	2,890	9,390	0.413	2.60	.00412
S-2.4	7,221	3,195	11,595	0.372	2.87	.00472
ACCESS TO						
S-2 FOR						
ALT. 4	5,381	4,021	11,495	0.468	3.61	.007
S2.5-150						
HIGH ROAD	4,556	3,455	9,980	0.457	3.10	.006
S2.5-151						
LOWER ROAD	5,633	4,179	10,460	0.538	3.75	.00614
S-3	6,249	4,620	11,440	0.546	4.15	.00692
S-4	5,953	4,412	10,930	0.545	3.96	.00651
S-4.4	6,257	4,629	11,455	0.546	4.16	.009
S4.5						
FINAL						
PLACEMENT &						
ROUTING FOR						
S-4 for						
ALT. 4	4,582	3,449	9,375	0.489	3.10	.00464
S-5	5,057	3,782	10,675	0.474	3.40	.00530
S 5.4						
ACCESS TO						
S-5 FOR	5,279	3,937	10,385	0.508	3.54	.00560
ALT. 4	4,294	3,247	9,600	0.447	2.92	.0006
S-6						
S-6.4						
ACCESS FOR	5,599	4,153	11,140	0.503	3.73	.00609
ALT.4						
S-7						
SOUTHERN						
ACCESS						
S-7	5,814	4,305	12,645	0.460	3.87	.00639
NORTHERN						
ACCESS	4,216	2,952	9,855	0.428	2.65	.00565
S-8	4,191	2,583	10,395	0.403	2.32	.005
S8.4						
TO AVOID						
COW CREEK						
E-1	2,172	1,697	6,060	0.404	1.52	.00178
E-2	4,506	3,399	10,055	0.483	3.05	.00452
E-3	3,435	2,619	8,565	0.401	2.35	.00326
E-4	3,793	3,049	7,650	0.496	2.74	.00388
E-5	5,582	3,500	10,665	0.523	3.14	.00601
E-6	5,310	4,111	10,750	0.494	3.69	.00597

Table L-3. Comparison of Cumulative Effects Model Outputs for each well site as if activities occured during SUMMER.

WELL SITE	HABITAL VALUE(HV)	REDUCTION IN HV	ACRES IN THE ZONE OF INFLUENCE (ZI)	SEASONAL HABITAT VALUE (SHV) IN ZI	% REDUCTION IN HABITAT EFFECTIVENESS (HE)	MORTALITY RISK INDEX (MRI)
B-1	5,667	4,210	10,445	0.543	3.78	.00614
S-1	4,272	3,284	7,870	0.543	2.91	.00420
S-2	3,877	2,890	9,390	0.413	2.60	.00412
S-2.4 ACCESS TO S-2 FOR ALT. 4	7,221	3,195	11,595	0.372	2.87	.00472
S2.5-150 HIGH ROAD	5,381	4,021	11,495	0.468	3.61	.007
S2.5-151 LOWER ROAD	4,556	3,455	9,980	0.457	3.10	.006
S-3	5,633	4,179	10,460	0.538	3.75	.00614
S-4	6,249	4,620	11,440	0.546	4.15	.00692
S-4.4	5,953	4,412	10,930	0.545	3.96	.00651
S4.5 FINAL PLACEMENT & ROUTING FOR S-4 for ALT. 4	6,257	4,629	11,455	0.546	4.16	.009
S-5	4,582	3,449	9,375	0.489	3.10	.00464
S 5.4 ACCESS TO S-5 FOR ALT. 4	5,057	3,782	10,675	0.474	3.40	.00530
S-6	5,279	3,937	10,385	0.508	3.54	.00560
S-6.4 ACCESS FOR ALT.4	4,294	3,247	9,600	0.447	2.92	.0006
S-7 SOUTHERN ACCESS	5,599	4,153	11,140	0.503	3.73	.00609
S-7 NORTHERN ACCESS	5,814	4,305	12,645	0.460	3.87	.00639
S-8	4,216	2,952	9,855	0.428	2.65	.00565
S8.4 TO AVOID COW CREEK	4,191	2,583	10,395	0.403	2.32	.005
E-1	2,172	1,697	6,060	0.404	1.52	.00178
E-2	4,506	3,399	10,055	0.483	3.05	.00452
E-3	3,435	2,619	8,565	0.401	2.35	.00326
E-4	3,793	3,049	7,650	0.496	2.74	.00388
E-5	5,582	3,500	10,665	0.523	3.14	.00601
E-6	5,310	4,111	10,750	0.494	3.69	.00597

Table L-4. Comparison of Cumulative Effects Model Outputs for each well site as if activities occured during FALL.

WELL SITE	HABITAL VALUE(HV)	REDUCTION IN HV	ACRES IN THE ZONE OF INFLUENCE (ZI)	SEASONAL HABITAT VALUE (SHV) IN ZI	% REDUCTION IN HABITAT EFFECTIVENESS (HE)	MORTALITY RISK INDEX (MRI)
B-1	6,623	4,958	10,445	0.634	4.06	.00692
S-1	4,707	3,592	7,870	0.598	2.94	.00444
S-2	4,319	3,226	9,390	0.460	2.64	.00456
S-2.4	4,883	3,620	11,595	0.421	2.97	.00533
ACCESS TO S-2 FOR ALT. 4						
S2.5-150	5,813	4,340	11,495	0.506	3.56	.008
HIGH ROAD						
S2.5-151	4,949	3,749	9,980	0.496	3.07	.007
LOWER ROAD						
S-3	6,630	4,962	10,460	0.634	4.07	.00692
S-4	7,125	5,254	11,440	0.623	4.31	.00798
S-4.4	6,574	4,868	10,930	0.601	3.99	.00722
S4.5	7,515	5,591	11,455	0.656	4.58	.010
FINAL PLACEMENT & ROUTING FOR FOR S-4 FOR ALT. 4						
S-5	5,216	3,944	9,375	0.556	3.23	.00518
S 5.4	5,710	4,290	10,675	0.535	3.52	.00586
ACCESS TO S-5 FOR ALT. 4						
S-6	6,045	4,524	10,385	0.582	3.71	.00632
S-6.4	4,799	3,652	9,600	0.500	2.99	.007
ACCESS FOR ALT.4						
S-7	6,275	4,656	11,140	0.563	3.82	.00684
SOUTHERN ACCESS						
S-7	6,251	4,639	12,645	0.494	3.80	.00680
NORTHERN ACCESS						
S-8	4,477	3,135	9,855	0.454	2.57	.006
S8.4	4,339	2,690	10,395	0.417	2.20	.005
TO AVOID COW CREEK						
E-1	2,451	1,918	6,060	0.404	1.57	.00199
E-2	4,855	3,664	10,055	0.483	3.00	.00485
E-3	3,747	2,844	8,565	0.438	2.33	.00364
E-4	5,061	4,046	7,650	0.662	3.32	.00519
E-5	7,158	4,564	10,665	0.671	3.74	.00795
E-6	6,977	5,387	10,750	0.649	4.42	.00783

COMPARISON OF ALTERNATIVES

Cumulative Effects Modeling outputs for the existing situation plus each alternative at full production are presented in Table L-5. Significant amounts of roading have already occurred in the BMU and much of this is in the EIS area. This roading has contributed to the reduced HE in the BMU. Fortunately, most of the heavy use of these roads is only during the fall hunting season. Habitat effectiveness has already been reduced 19.31, 29.78, and 45 percent in the spring, summer, and fall, respectively.

Outputs were calculated for each alternative at full production to see what the increases in negative influence on grizzly bears and their habitat would be. Again, the relative meaning of the magnitude of the number changes are difficult to interpret with such a new model. But, as expected, the greatest negative effects occur when the most sites are developed with the most on site activity (Alternative 2). Increases from the existing situation in per cent reduction in HE and MRI are given in Tables L-6 and L-7. As shown the greatest increase in reduction in HE and increases in MRI occur Alternative 2 in the spring as 2.73 percent and 0.103, respectively. Effects lessen as the number of sites are reduced and less production activity occurs on site (Alternatives 4, 3, and 1).

As previously discussed, the face of the Rocky Mountain Front and riparians of the adjoining prairie are critically important to grizzly bear during the spring. Care should be taken (and has been in siting past proposals) to separate oil and gas activities from important high value spring habitats by avoiding them in both time and space. Time mitigation is generally easy to apply especially during exploration by adhering to a fall drilling window. Special mitigation may be harder to apply and exploration of some adjacent sites may be staggered over years.

Table L-5

Results of Cumulative Effects Modeling for the Existing Situation in the Birch-Teton Bear Management Unit and for four Production Scenarios given as Alternatives in the Blackleaf EIS.

	BASE EXISTING SITUATION			ALTERNATIVE 1			ALTERNATIVE 3			ALTERNATIVE 4			ALTERNATIVE 2		
	SPRING	SUMMER	FALL	SPRING	SUMMER	FALL	SPRING	SUMMER	FALL	SPRING	SUMMER	FALL	SPRING	SUMMER	FALL
HV	.642	.511	.560	.642	.511	.560	.642	.511	.560	.642	.511	.560	.642	.511	.560
HB	.518	.359	.308	.513	.358	.308	.511	.357	.306	.507	.356	.306	.501	.352	.300
% Reduction	19.31	29.78	45.00	20.11	29.82	45.04	20.49	30.11	45.33	21.03	30.20	45.39	22.04	31.04	46.43
Habitat Units Reduced	27,035	33,142	54,907	28,148	33,190	54,952	28,684	33,509	55,313	29,439	33,611	55,378	30,852	34,555	56,650
MRI	.087	.115	.324	.092	.115	.325	.094	.116	.326	.098	.117	.327	.103	.121	.332

Alternative 1: Provides for production of I-13, I-19, I-5, I-8 wellsites with a central gas plant. Only difference between this and existing situation is year long operation at the sweetening plant and access roads to wellsites.

Alternative 2: Provides for production of all wellsites except exploratory wells. Includes production facilities at each wellsite, therefore, there is a zone-of-influence around each wellsite plus access roads.

Alternative 4: Provides for production of all wells except S-6 and S-7 and the exploratory wellsites. Includes 24 hour operation of sweetening plant, utilizes remote monitoring of wellheads, year long use either for high or low use. One Basic Assumption used: gas use will not raise any use of the road above what it is classified in the existing situation because of remote monitoring.

Alternative 3: Same situation as Alternative 4 except fewer wellsites are programmed.

Table L-6

Per Cent Reduction in Habitat Effectiveness (HE) by season for the existing situation (base) and each Alternative and increase in (HE) when at full production.

	SPRING		SUMMER		FALL	
ALTERNATIVE	HE	INCREASE FROM BASE	HE	INCREASE FROM BASE	HE	INCREASE FROM BASE
EXISTING SITUATION (BASE)	19.31		29.78		45.00	
1	20.11	0.8	29.82	0.04	45.04	0.04
3	20.49	1.18	30.11	0.33	45.33	0.33
4	21.03	1.72	30.20	0.42	45.39	0.39
2	22.04	2.73	31.04	1.26	46.43	1.43

Table L-7

Mortality Risk Index (MRI) by season for the existing situation (base) and each Alternative and increase in MRI when at full production.

	SPRING		SUMMER		FALL	
ALTERNATIVE	MRI	INCREASE FROM BASE	MRI	INCREASE FROM BASE	MRI	INCREASE FROM BASE
EXISTING SITUATION (BASE)	0.087		0.115		0.324	
1	0.092	0.005	0.115	same	0.325	0.001
3	0.094	0.007	0.116	0.001	0.326	0.002
4	0.098	0.011	0.117	0.002	0.327	0.003
2	0.103	0.016	0.121	0.006	0.332	0.008

SIMULTANEOUS EXPLORATION AND PRODUCTION

Until all sites have been explored and the final production scenario has actually been defined, all scheduling of exploration wells will be conjecture. BLM cannot dictate to a lessee or unit manager when to file an Application for Permit to Drill (APD), but BLM could delay approval of an APD for a drilling season if too many activities were scheduled and the existence of an endangered species was in question. Each year as the field develops new levels of impact would be exerted on grizzly bears and the new impacts would be additive to those still existing including effects of producing wells. As exploration ceases and production activities are defined the additive (cumulative) effects will lessen.

In the scenario described in the preferred alternative the years of the greatest negative effects on grizzly bears would be when more than one well in the EIS area are in the exploration phase. This is apparent when Tables L-2, L-3, L-4 showing HE and MRI for individual wells are studied. Relative effects of combinations of explorations occurring in the same year can be envisioned. It would appear that during 1993-94, when S-4 and S-5 are both in the exploration phase the highest impacts would probably occur.

Thus, as one can see on Table L-9 the increase in HE is over 3 times greater during the years when these more difficult wells, S-4 and S-5, are being explored than when full production is reached in the preferred Alternative. It would appear that during these years the maximum negative effect on bears would occur. In other words, the maximum reduction in HE anticipated would be 26.46% if S-4 and S-5 were explored during the spring periods of 1993 and 1994 (Table L-8), and this reduction is 7.15% greater than the reduction existing for the BMU at the present time (Table L-9). Should the field develop at a slower rate and less overlap in drilling of exploration sites occurs, less maximum reduction in HE for any given year would result. The sequence of events proposed are very ambitious and less activity than proposed would likely be the real situation for any given year.

Table L-8.
Years of maximum effect on grizzly bears, 1993-94, when two of the more difficult wells are being explored (S-4 and S-5).

	SPRING	SPRING	FALL
HV	.642	.511	.560
HE	.472	.339	.291
% Reduction	26.46	33.66	48.00
Habitat Units Reduced	37,045	37,468	58,571
MRI	.103	.121	.330

Table L-9
Increase in the percentage of reduction in Habitat Effectiveness in the BMU as compared to Existing Situation for all alternatives and during the years of maximums negative effect, 1993-94 1>.

	1	3	4	2	S-4 and S-5 (During 1993, 94)
Spring	0.8	1.18	1.72	2.73	7.15
Summer	0.04	0.33	0.42	1.26	3.88
Fall	0.04	0.33	0.39	1.43	3.00

1> These modeling outputs assume that exploration of these two wells is occurring thru all seasons.

DETERMINATION OF EFFECT FOR GRIZZLY BEAR.

The Interagency Rocky Mountain Front guidelines will be adhered to except for minor variations as identified in the EIS., ie) timing window in Alternative IV. Guidelines applicable to grizzly bear include the general management guidelines on pages 3 and 4 and the grizzly bear specific guidelines on page 10. (BLM, et. al 1987).

Strict application and adherence to these guidelines will significantly lessen the adversity of these activities, especially exploration which can be programmed in an appropriate late summer of fall drilling window. Effects from production are harder to mitigate. Employment of remote monitoring (Alternative 1, 3, and 4) and proper road management (All Alternatives) will lessen, <u>BUT NOT ELIMINATE</u> these adverse effects, therefore, we must determine that grizzly bear may be affected by any of these alternatives and we request a Fish and Wildlife Service opinion on each.

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IN REPLY REFER TO:
M.02 Blackleaf Oil/Gas
Field Development

December 20, 1989

MEMORANDUM

To: District Manager, Lewistown District Office, Bureau of Land Management, Lewistown, MT

From: Field Supervisor, Montana/Wyoming Field Office, Fish and Wildlife Enhancement, U.S. Fish and Wildlife Service, Helena, MT

Subject: Section 7 Consultation - Blackleaf Oil and Gas Field Development

This is the U.S. Fish and Wildlife Service's (Service) biological opinion prepared in response to your September 19, 1989 request for formal consultation under Section 7 of the Endangered Species Act on the Blackleaf Oil and Gas Field Development Environmental Impact Statement.

This biological opinion considers the effects of field development in the Blackleaf area (Figure 1.1, Appendix A) as outlined in the preferred alternative (Alternative 4) of the Preliminary Draft Environmental Impact Statement (PDEIS). This opinion, however, is restricted in scope to the existing wells and the step-out wells identified in Alternative 4 and does not cover the six exploratory wells identified as part of all alternatives analyzed in the PDEIS. The PDEIS and biological assessment for endangered and threatened species do not analyze the consequences of all stages of oil/gas activities associated with the six exploratory wells. Based on Conner v. Burford, 836 F 2d 1521, the Endangered Species Act requires the Service to consider all stages of the agency action (i.e, exploration through production and abandonment) in its biological opinion using the best scientific and commercial data available. According to Conner v. Burford, staged consultations on oil/gas activities does not meet the intent of the Endangered Species Act. Therefore, before an application for permit to drill (APD) for any of the six exploratory wells can be approved, the Bureau of Land Management (BLM) must assess the consequences of all stages of its actions and submit this information along with a request for formal consultation to the Service. Upon receiving a request for formal consultation, the Service will issue a comprehensive biological opinion considering all stages of the activity.

Based upon our review of the biological assessment and the September 1989 PDEIS, the Service concurs with the conclusions reached in the biological assessment that there will be no adverse effects upon the bald eagle and peregrine falcon. This biological opinion considers the potential effects

of exploration, development and production from the two existing wells (1-5 and 1-8) that are producers, the two existing shut-in wells (1-13 and 1-19), six step-out wells (S-1, S-2, S-3, S-4, S-5, and S-8) and one injection well on the grizzly bear and gray wolf (Figure 2.9, Appendix B). The overall environmental acceptability of the proposed actions are not considered. The Service has examined the proposed actions in accordance with the procedural regulations governing interagency cooperation under Section 7 of the Endangered Species Act of 1973, as amended (50 CFR 402 and USC 1531 et seq.).

BIOLOGICAL OPINION

It is the Service's biological opinion that field development in the Blackleaf EIS analysis area as outlined in Alternative 4 of the PDEIS and biological assessment is not likely to jeopardize the continued existence of the grizzly bear and gray wolf. The scope of this opinion does not include the exploratory wells identified in Alternative 4.

This opinion is contingent upon:

1. the project being designed and implemented as described in the preferred alternative identified in the PDEIS and biological assessment and as summarized in the project description of this opinion;

2. the mitigation and coordination measures outlined in the PDEIS, biological assessment, and in this opinion (reference PROJECT DESCRIPTION) are implemented and followed;

3. technology is available to remote monitor the well heads; and

4. no more than two step out wells may be drilled concurrently.

PROJECT DESCRIPTION

The Blackleaf EIS identifies alternatives for field development of the two known gas structures (known as the Blackleaf Production Unit) and establishes the sideboards that govern the extent and manner in which field development will occur. Full field development includes all development activities including exploration of step out wells, production facility development, placement of transportation networks and abandonment.

The Blackleaf Production Unit currently has two producing wells (wells 1-5 and 1-8) and two shut-in wells (1-13 and 1-19) capable of production. The preferred alternative for field development consists of the following:

Existing Wells	2
Shut-in Wells brought on line	2
Injection Wells	1
Step Out Wells	6
Total Wells	11

Gas Processing Facility	1
Total Road Miles in Use	63.45*
Total New Road Construction	6.5
New Pipeline Outside of Road ROWs	23.9 miles
New Pipeline Inside of Road ROWs	12.65 miles
Existing Pipeline	3.25 miles
Total Pipeline Miles	39.8**
Time Frames	
Active Drilling Program	1991-2003
Well Field Maintenance	1983-2026
Abandonment and Rehabilitation	2024-2026 (last 2 years of field life)

* The total road miles figure reflects counting some segments of the total road system multiple times since some segments would be used to access multiple wells. This was done to give the reader the total length of road to be used for each well site.

** The reason for high number of pipeline miles is that each well is metered at the gas plant requiring a separate line for each well. Many of these pipelines will be laid in the same right-of-way.

A central gas processing facility would be located on private surface over Federal minerals (T26N, R8W, Section 8), thus eliminating the need for production facilities at each wellhead. The only facilities located at each wellsite would be the wellhead, some corrosion inhibitors (to be injected into the gas stream prior to putting it into the pipeline) contained inside a small building on-site and separation and dehydration facilities for separation of water, gas and gas condensate. Each wellsite would be remotely monitored from the central gas processing facility via computer capabilities. Initially, each well would be visited a maximum of once per day unless there were problems. This level of visitation would occur during the first year or at least through the first winter until all problems are worked out.

The gas bearing geologic structures being tapped by the wells will cease production in about 25 years at which time the wellheads, gas processing facility, pads and roads would be removed and rehabilitated to as near natural conditions as possible.

Wellsite access roads in the EIS area will be closed to motorized use by the public. Existing arterial and collector routes in the EIS area will remain open to public use to maintain existing access to public lands (Figure 4.4, Appendix C). Seasonal closures for wildlife purposes and resource protection will remain as currently managed. Roads which access non-producing wells will be closed and reclaimed.

All wellsite construction, maintenance and other proposals and activities would be required to meet the following requirements:

1. use a July 15 to December 15 timing window for any activity located in the areas cross-hatched on the Alternative 4 map (Appendix B) to minimize disruption to wildlife species. Within this time period the authorizing agencies would select the appropriate 105 day (3-1/2 month) operating period which would have the least adverse impact on wildlife;

2. site construction would be allowed the first year of operation and drilling allowed the following year if it appears both cannot be completed within the prescribed time window;

3. all productive wells will be remotely monitored to minimize maintenance visits;

4. proposals for concurrent activities (to be active during the same period) must be separated by at least a major drainage in critical areas or a minimum one mile distance at the agencies discretion based upon site specific location, resources and topography;

5. areas not cross-hatched on the Alternative 4 map (Appendix B) are areas with the least restrictions due to wildlife habitat and could sustain year-round oil and gas activity;

6. APDs must be filed 120 days in advance of any proposed activity so that the required evaluations may be completed;

7. the Management Guidelines for Selected Species, Rocky Mountain Front (RMF) Studies (RMF Guidelines), will be applied to all oil and gas activities; and

8. a no firearms policy as required by the RMF Guidelines for company employees while on duty will be enforced.

Current Status of the Grizzly Bear

There is an estimated current population of 549-813 grizzly bears for the Northern Continental Divide grizzly bear ecosystem (Montana Department of Fish, Wildlife and Parks, Grizzly Bear EIS, 1986). Using data from Aune et al. (In Prep.), the Service estimated for purposes of this consultation a population of 34.3 to 45.7 grizzly bears in the Birch-Teton Bear Management Unit (BMU). Counts in the Birch-Teton core study area of marked and unmarked grizzly bears (unduplicated bears) minus the recorded mortality averaged 27.4 bears. Using a counting efficiency of 60-80%, we calculated 34.3 to 45.7 grizzly bears in the BMU (27.4/.80 = 34.3; 27.4/.60 = 45.7). Trend data examined for grizzly bears on the East Rocky Mountain Front indicated a stable or perhaps slightly increasing population during the period 1977-1987 (Aune et al., In Prep.).

The recovery goals for the grizzly bear population in the Northern Continental Divide Ecosystem (Ecosystem) were established in the 1982 Grizzly Bear Recovery Plan as:

- a population of 440-680 with a mean goal of 560 bears; and

- attainment of a set of biological parameters.

Parameters for assessing population status have been identified for inclusion in the revision of the 1982 Grizzly Bear Recovery Plan. These parameters include; (1) the unduplicated sightings of females with cubs of the year, (2) distribution of females with young in the Ecosystem; (3) mortality, and (4) a conservation strategy. Targets for parameters 1, 2 and 3 are presently being established. The Conservation Strategy is in preparation by an Interagency Working Group. Table 1 presents population parameters from the 1982 Grizzly Bear Recovery Plan, the draft recovery parameters and their targets being considered for the revised Recovery Plan, and current parameter estimates.

Table 1. Grizzly Bear Population Status in the Northern Continental Divide Ecosystem

PARAMETERS	1982 RECOVERY PLAN*	CURRENT ESTIMATE**
POPULATION GOAL:	560	549 - 813
MEAN CUB LITTER SIZE	1.78	1.7 - 2.66
MEAN LITTER FREQUENCY (YEARS) (REPRODUCTIVE CYCLE)	3.0	2.1 - 3.3
MEAN PRODUCTION RATE (REPRODUCTIVE CYCLE)	0.593	0.515 - 1.267
ANNUAL NUMBER OF FEMALES WITH CUBS	56.0	68
AVERAGE ANNUAL KNOWN MAN-CAUSED MORTALITY	25.0	18.2
AVERAGE ANNUAL TOTAL MORTALITY AS % OF TOTAL POPULATION	17.1 - 18.7	(7.1 MAN-CAUSED)

*STATISTICS OR THEIR BIOLOGICAL EQUIVALENTS COMPUTED AS A RUNNING SIX-YEAR AVERAGE (PAGE 60)

**MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS LETTER DATED NOVEMBER 28, 1988

PARAMETERS	DRAFT REVISED RECOVERY PLAN	CURRENT ESTIMATE
PRODUCTION - UNDUPLICATED COUNT OF FEMALES WITH CUBS OF THE YEAR	22*	29.0 (1987-27; 1988-25; 1989-35)
OCCUPANCY - COUNT FEMALES WITH OFFSPRING	AT LEAST 1 FAMILY UNIT IN 20 OF 24 BMU**	21 (1987-89)
MORTALITY - INVENTORY ALL	NTE 14 TOTAL PER YEAR KNOWN HUMAN-INDUCED OR (6) FEMALES OUTSIDE GNP	12(6) - 1986 9(6) - 1987 8(6) - 1988 12(5) - 1989
HABITAT - MAINTAIN EFFECTIVENESS CONSERVATION STRATEGY PLAN	AS DEVELOPED, UTILIZE CUMULATIVE EFFECTS MODEL (CEM)	ON-GOING; UTILIZE BEST DATA AVAILABLE

*COMPUTED AS A RUNNING THREE YEAR AVERAGE. GNP = Glacier National Park
**COMPUTED AFTER THREE-YEARS OF CUMULATIVE REPORTS NTE = not to exceed

Current Status of the Gray Wolf

Natural recolonization is presently occurring in northwestern Montana as a result of dispersal of animals from wolf populations in Alberta and British Columbia and subsequent reproduction near the international border. Reproduction was first discovered in 1982 in the North Fork Flathead River drainage three miles north of Glacier National Park (GNP) with subsequent denning in GNP in 1986. Of four packs (Wigwam, Sage Creek, Headwaters, and Camas) that occurred in the North Fork Flathead River drainage during 1987, two packs now exist (Headwaters and Camas). Since 1986, wolf numbers have ranged between 15 and 26 animals. The population goal for down-listing wolves in the northwest Montana recovery area is 10 packs.

There have been 115 wolf occurrence reports recorded on the East Rocky Mountain Front during the period 1978 to 1989 (U.S. Fish and Wildlife Service files). Sixty-nine percent of these occurred within the last five years (1985-89). While available data do not indicate sustained pack activity on the East Front, the potential for pack formation and recolonization through natural recruitment appears eminent.

BASIS OF OPINION

Grizzly Bear: The pattern of grizzly use along the Rocky Mountain Front is largely determined by availability and phenology of plants that serve as food sources determined by food habit analysis, radio locations of radio-collared bears, and analysis of habitat use by month (Aune et al., In Prep.). During the spring, summer and early fall, Antelope Butte and Pine Butte Swamps and the riparian corridors along creek drainages provide the grasses, sedges and forbs sought by bears. During the spring 80.3% of all radio locations were

below 6,560 feet in elevation. Receding snowline and plant phenology influences the elevational distribution of bears during the spring. The elevational distribution during the summer is broad, encompassing all elevational zones. During the fall there is a bimodal distribution of elevations used by grizzly bears. Fruits of buffaloberry, serviceberry, chokecherry and grouse whortleberry at the lower elevations become increasingly important in the diet of bears in August and September. In September, for bears south of Birch Creek the food habits shift to whitebark pine nuts (93% of radio locations) at elevations above 6,200 feet. Very few cases of bears feeding on limber pine nuts were recorded (Aune et al., In Prep.).

For all grizzly bears, den entrance ranged between October 10 and December 5 with a median date of November 6. Movement to dens occurred from October 6 to approximately December 1. Den sites ranged in elevation from 5,100 feet to 8,167 feet with a mean of 7,055 feet. Ninety-five percent of the dens were above 6,232 feet. Emergence dates ranged between March 10 and May 13 with a median date of April 7.

Aune et al. (In Prep.) observed various patterns of elevational migration in grizzly bears on the Rocky Mountain Front. Two common patterns included lowland bears who migrated from denning habitat to low elevations and remained until a predenning-denning period and an upland pattern (backcountry bears) which included a spring season migration to lowlands, then a return to higher elevation during the summer and fall. Occasionally the upland bears would return to lower elevations during the berry season in late summer and fall.

The East Front grizzly bear studies (Aune et al., In Prep.) provides extensive data on habitat selection and use, population status and response of bears to human activities. These data and the guidelines developed from the East Front Studies (RMF Guidelines) provide a solid basis for designing and coordinating gas development in the Blackleaf area and assessing its impact.

Potential impacts to grizzly bears from hydrocarbon exploration and development are discussed and summarized in the Grizzly Bear Compendium (National Wildlife Federation, 1987). Potential impacts may be categorized as follows:

1. loss of habitat due to activities that adversely modify or destroy important habitat components;
2. loss of habitat due to displacement;
3. increased mortality risk; and
4. cumulative impacts of all past and present Federal, State and private actions.

Loss of Habitat due to Activities that Adversely Modify or Destroy Important Habitat Components

Construction of the access roads and drill pads is the activity most likely to adversely modify or destroy important habitat components for the grizzly bear. Access to the well sites requires an improved gravel road 12 to 16 feet wide

and the drill pads are 2 to 5 acres in size. Thus, the six step out wells, four existing wells, and sweetening plant will directly impact approximately 43 acres. Their access roads will impact approximately 24 acres.

The Rocky Mountain Front Guidelines (Part A, Guideline #10 and Part B, Guideline #2) require that roads and drill sites be located to avoid important wildlife habitat components. Specific locations for each step-out well and access road will be determined at the time an APD is received and a site review made so that the drill site and roads are located to avoid important foraging components. Habitat components that contain important bear foods such as riparian shrub types, Populus stands, marshes, fens, etc. will be avoided, thereby minimizing any direct loss or modification of important components. Through informal consultation the general location of each step out well was reviewed with biologists from the BLM, Forest Service, Montana Department of Fish, Wildlife and Parks and the Service for its impact on grizzly bears. Based on recommendations from this group of Interagency biologists, step-out wells 6 and 7 were removed from Alternative 4 and changes in wellsite locations and access roads made for several step-out wells (BLM, Biological Assessment for Endangered and Threatened Species). The gas processing plant located in T26N, R8W, Section 8 is far enough removed from important grizzly bear habitat components that its construction, operation and remote monitoring of the wellheads from this location will be compatible with grizzly bear use of the East Front.

The Service therefore believes that the magnitude of direct habitat loss through physical alteration/destruction of habitat is not at a level that is expected to reduce the reproduction, numbers, or distribution of the grizzly bear.

Loss of Habitat Due to Displacement of Animals

The loss of bear use of important habitat components on the East Rocky Mountain Front due to long-term displacement as a result of oil/gas activities is a much greater concern to the Service than is direct habitat loss due to the roads and drill sites. If oil/gas operations are at levels that cause displacement of bears for extended periods of time, historical bear use of the area may be lost, particularly to females. Aune et al. (In Prep.) and McLellan (Pers. Comm. 1989) showed that female cubs generally establish their home range within or have a significant overlap with their mother's home range, while males generally disperse from their mother's home range. Long-term displacement of a female from a portion of her home range may result in that area being lost to female bears since her offspring have no chance to learn the foraging opportunities in areas no longer used.

Aune et al. (1982, 1983, 1984) studied the effects of drilling operations on the movements, home range, and habitat use of grizzly bears on the East Rocky Mountain Front. They compared the geometric activity centers of bears in consecutive pre- and post-disturbance years and found that grizzly bears were not displaced from their seasonal ranges by drilling operations (Aune et al. 1983, 1984). Although seasonal geometric activity centers did shift from one year to the next, these shifts were attributed to food availability, reproductive status and age/sex class. Grizzly bears did appear to be temporarily displaced from areas immediately around active drill sites. For most bears, a minimum impact zone of about 0.5 miles existed around active

wells. This distance varied depending on the degree of habituation of individual bears and the cover and topography of the area. Grizzly bears began to reuse the area around the drill site once human activity at the site tapered off (Aune et al. 1984). Increased road construction was considered the most serious impact of oil and gas development in the area (Aune and Stivers 1983, Aune et al. 1984). Other research studies have also confirmed the temporary displacement of bears along road corridors (National Wildlife Federation, 1987). McLellan and Shackelton (1988) showed that most grizzly bears used areas near open roads significantly less than expected. This was equivalent to a habitat loss of 58% in the 0-100 meter distance from road category and 7% in the 101-250 meter distance from road category. For the whole Flathead study area it represents a loss of 8.7% of the area available to grizzly bears.

Harding and Nagy (1980) in studying grizzly bear responses to hydrocarbon exploration on Richards Island, Northwest Territories, Canada, concluded that although grizzly bears did not avoid the general area of industrial activity, they did avoid the area within 0.6 miles of drill sites, camps, etc. Of 13 to 24 grizzly bears in the area only 6 ever entered the immediate area of industrial activity. They concluded that the grizzly bear population had apparently adapted to existing facilities. However, as new industrial activities were introduced to the Island, the population might be jeopardized. Of greatest concern was the construction of new all weather roads, disturbance of denning bears, marginal habitat loss and relocation of problem bears from construction camps.

Our no jeopardy conclusion is based in part on the following:

1. Adherence to a July 15 to December 15 timing window within which a 3-1/2 month operating period would be selected for road construction, drilling, and heavy maintenance activities.

   Due to the seasonal restrictions placed on field development, displacement and hence reductions in habitat effectiveness during the critical spring period would not occur during the construction and development phase of the step-out wells. In areas where berry production is an important fall food source, an operating period of September 1 to December 15 would allow bears to utilize berry crops before they are desiccated. While some bears may remain in the lowlands near riparian areas and Antelope Butte Swamp, many move up in elevation in September in search of pine nuts and to select and prepare their winter dens. Thus the overlap of road construction and drilling with fall bear use will be minimized. Displacement of bears during the summer and early fall is less critical than in the spring because foraging opportunities are spread over the entire landscape rather than being restricted to low elevations below the snowline.

2. Restricting exploration of step-out wells to no more than two wells drilled concurrently.

   It is recognized that some overlap of grizzly bear use and field development activities will occur. It is extremely important that adequate available space containing the biological components required by grizzly bears be available when bears are displaced by field

development activities. Information on displacement of grizzly bears from the literature was incorporated into the cumulative effects model (CEM) developed for the East Rocky Mountain Front (Forest Service et al., 1987) and the model run to evaluate the loss of habitat effectiveness on a seasonal basis for exploration of each well and the habitat effectiveness when all the wells are brought into production. Habitat units (habitat quality and quantity) calculated by the CEM provides a means of quantifying the loss or gain in habitat due to human activities and are used in calculating habitat effectiveness. The habitat unit is an expression of available seasonal habitat in units that can be measured, duplicated in other areas that have been habitat component mapped and then used for comparison purposes. Thus, habitat units may be used to quantify habitat quality in a BMU or within a zone of influence associated, for example, with a drillsite or access road.

Habitat units were calculated (Table 2) by season for the:

(1) Birch-Teton BMU in the absence of all human activities (optimum habitat),

(2) existing situation (environmental baseline),

(3) the environmental baseline with two and three wells being drilled concurrently, and

(4) the environmental baseline with all wells brought into production.

Table 2. Seasonal Habitat Units for the Birch-Teton BMU with No Human Activity (Optimum Habitat), Environmental Baseline (Existing Situation), Production (Alternative 4), and Exploration for 2 and 3 Wells Drilled Concurrently

	OH	E	ALT. 4 - P	EXPL. S-4 & S-5	EXPL. S-2 & S-8	EXPL. S-2, S-4 & S-8
Spring						
Habitat Units (HU)	140,078	113,043	110,639	103,033	103,537	96,515
HU Reduced		27,035	29,439	37,045	36,541	43,563
%HU Reduced		19.3	21.0	26.5	26.1	31.1
%HU Remaining (HE)		80.7	79.0	73.5	73.9	68.9
Summer						
Habitat Units	111,215	78,073	77,604	73,747	72,035	67,406
HU Reduced		33,142	33,611	37,468	39,180	43,809
%HU Reduced		29.8	30.2	33.7	35.2	39.4
%HU Remaining (HE)		70.2	69.8	66.3	64.8	60.6
Fall						
Habitat Units	122,015	67,108	66,637	63,444	60,669	55,078
HU Reduced		54,378	55,378	58,571	61,346	66,937
%HU Reduced		45.0	45.4	48.0	50.3	54.9
%HU Remaining (HE)		55.0	54.6	52.0	49.7	45.1

OH = Optimum Habitat (absence of all human activities) HE = Habitat Effectiveness
E = Environmental Baseline (Existing Situation)

The number of habitat units in the absence of all human activity represents the resource cushion that grizzly bears have available to meet their biological requirements. As human activities are superimposed over bear habitat, habitat units are either permanently or temporarily made unavailable to bear use, thus reducing the resource cushion. The CEM calculates the loss or gain of habitat units as human activities are added to or removed from bear habitat. Theoretically, the resource cushion could be reduced to a point where the grizzly bear population could no longer meet its biological requirements, thereby jeopardizing its existence.

To date, no process for establishing thresholds has been completed on grizzly bear cumulative effects models to define and validate threshold levels required to meet recovery targets. The cumulative effects analysis process developed on the Kootenai National Forest (Christensen and Madel 1982) has operated under a philosophy of maintaining a minimum of 70% freely available space (habitat effectiveness) throughout BMUs on the Forest. Managers commonly use threshold habitat effectiveness levels between 70-80% for non-listed species such as elk.

The CEM indicates that, on average, the habitat effectiveness in the Birch-Teton BMU is reduce by 3.5% for each well drilled during the summer and fall seasons (Table 2). Thus, two wells drilled concurrently reduces the habitat effectiveness in the BMU by 7% and three wells drilled concurrently would reduce habitat effectiveness by approximately 10.5%. Table 2 shows that for the summer season the existing habitat effectiveness is 70.2% and would be reduced to 66% if two wells were drilled concurrently and further reduced to 60% if three wells were drilled concurrently. Similarly, in the fall the existing habitat effectiveness is 55%, but would be reduced to 52% if two wells were drilled, and down to 45% if three wells were drilled concurrently. The low fall habitat effectiveness ratings for the existing situation is largely attributed to open roads and to the high hunting pressure that the East Front receives during the hunting season. A computer run of the CEM indicated that in the absence of hunting, exiting fall habitat effectiveness would be 65.4% (Don Godtel, Pers. Comm., 1989). While thresholds for habitat effectiveness have not been established, habitat effectiveness levels drop well below 70% when three wells are drilled concurrently. The Service believes that drilling three wells concurrently would excessively remove from bear use habitat needed for their long-term survival and recovery and should be prohibited.

Figure 1 (Appendix D) shows the number of wells drilled on the East Rocky Mountain Front between 1979 and 1987. Of these wells, 10 were drilled in the Birch-Teton BMU, an average of two wells per year (Day, Pers. Comm., 1989). Grizzly bears that were impacted by exploration of the Blackleaf natural gas field during 1980-84 were monitored as part of the East Front Grizzly Studies. Aune et al. (In Prep.) concluded that oil and gas activities at the level experienced by these bears did not cause them to be displaced from their annual home ranges and that the population remained stable or is slightly increasing. Thus, if mortality is managed and regulated as discussed below in this opinion, the Service believes

that two wells can be drilled concurrently without significantly reducing the reproduction, numbers, or distribution of the grizzly bear.

3. One central gas processing plant allowing for remote monitoring of wellheads and closing access roads to wells to motorized use by the public.

   Production facilities will be off-site as outlined in the project description and the wellheads remotely monitored from one central gas processing plant. This technology greatly reduces the need for daily/weekly visits to the well site, thereby minimizing disturbance to bears and other wildlife during the production phase of each well. With public road closures and remote monitoring in place, habitat effectiveness is reduced 1.7%, 0.4%, and 0.4% for the spring, summer and fall seasons, respectively, from the existing situation when all wells are brought into production. The remaining habitat effectiveness levels would be 79.0%, 69.8%, and 54.6% for the spring, summer and fall seasons, respectively (Table 2). The small reduction in habitat effectiveness from the existing situation for the production phase is attributed to:

   (1) seasonal restrictions on when construction and heavy maintenance of wells may occur,

   (2) prohibiting public traffic on the access roads to well sites, and

   (3) low levels of employee visitation to the wellsites due to off-site location of production facilities and remote monitoring of well heads.

4. The location of field development in relation to potential denning habitat that prevents denning activities by bears from being impacted.

   Ninety-five percent of all grizzly bear dens located on the East Rocky Mountain Front were above 6,232 feet in elevation. Den sites ranged in elevation from 5,100 feet to 8,167 feet, with a mean of 7,055 feet (Aune et al., In Prep.). As a result, potential denning habitat is not effected by the field development (Figure 2, Appendix E).

   Therefore, if seasonal operating periods and road restrictions are adhered to, remote monitoring required and enforced, and no more than two wells drilled concurrently, impacts to grizzly bears from displacement during exploration and production is not expected to affect the numbers, reproduction or distribution of the grizzly bear at a level that would jeopardize the continued existence of the species.

Increased Mortality Risks

The scientific literature indicates that the greatest impact to grizzly bears from oil and gas activities results from increased human access into bear habitat, thereby increasing mortality risk to bears. Our no jeopardy conclusion is dependent, in part, on the following factors:

1. new access roads to wellsites will be obliterated and revegetated in the case of dry wells, and in the case of producible wells the access routes will be closed to motorized use by the public;

2. a no firearms policy for industry employees while on duty;

3. the requirement to incinerate garbage daily or store in bear proof containers and to remove to local land fill dumps on a daily basis; and

4. no work camps at the drill site. Work camps would introduce attractants (cooking odors, foods, garbage accumulation, etc.), increasing the possibility of human/bear conflicts.

During the period 1985 through 1989, six grizzly bears in the Birch-Teton BMU have been documented as lost to the population from all causes, an average annual loss of 1.2 bears/year (Mike Madel, Pers. Comm. 1989). The Montana Department of Fish, Wildlife and Parks, in developing its proposed levels of hunting, reviewed data from several studies and determined that an average annual human-induced mortality of 6% of the total population could be sustained and still experience a general increase in numbers (Montana Department of Fish, Wildlife and Parks 1986). Applying this 6% figure to the population estimate of 34.3 to 45.7 bears in the BMU yields 2.06 to 2.74 bears that theoretically could be taken per year without experiencing a population decline. Unknown, unreported illegal mortality for the Northern Continental Divide Ecosystem (NCDE) population is estimated at 2% (Revision of Special Regulations for the Grizzly Bear, Final Rule; 51 FR 33753). Adjusting the theoretical acceptable mortality level to account for unknown illegal mortality yields 1.37 to 1.83 bears that could be taken per year (known mortality) without experiencing a population decline (34.3 X .02 = .69; 45.7 X .02 = .91; 2.06 - .69 = 1.37 and 2.74 - .91 = 1.83).

The present mortality level (1.2 bears/year) within the BMU falls below the acceptable theoretical mortality limits (1.37 - 1.83 bears/year) for the estimated grizzly bear population within the BMU. Based on the assumptions that: (1) access roads to wellheads will be closed to motorized use by the public, (2) road restrictions are legal and will be enforced, and (3) a no firearms policy for company employees will be in effect, mortality risks theoretically can be held to levels that exist at the present time (Table G-7, Appendix F). Any known mortality that occurs will be counted against the quota of 14 bears or 6 females (whichever occurs first) established to regulate hunting seasons for the grizzly bear in the NCDE (50 CFR Part 17). We thus conclude that the mortality level is, and with the incorporation of the above factors 1-4, will continue to be sufficiently managed to preclude jeopardy to the species.

Impacts of Past and Present Federal, State and Private Actions

The CEM was used to evaluate the impacts of all past and present Federal, State and private actions in the analysis area (Birch-Teton BMU). The environmental baseline included all human activities such as roads, trails, recreational activities (dispersed and concentrated), campgrounds, administrative sites, home sites, livestock grazing, etc. Human activities were mapped and digitized according to procedures outlined in the cumulative effects analysis process (Forest Service et al., 1987). The CEM was then run

to establish the level of habitat effectiveness for the existing situation (environmental baseline) and then runs were made to evaluate exploration of individual wells and production from all wells measuring them against the existing situation (reference Bureau of Land Management Biological Assessment).

Table 2 shows the resource cushion (habitat units) as it has been reduced by; (1) the environmental baseline (existing situation), (2) exploration when two wells are drilled concurrently, (3) exploration when three wells are drilled concurrently, and (4) production when all wells are brought into production. For the production scenario, the data indicate that the resource cushion remains at 79, 69.8 and 54.6% of its optimum for the spring, summer and fall seasons, respectively. The exploration of two wells drilled concurrently would represent a worst case scenario under Alternative 4 with respect to cumulative impacts. Should such a situation develop the resource cushion would remain at approximately 74, 66, and 52% of its optimum for the spring, summer and fall seasons, respectively. As discussed earlier, approximately 10% of the reduction in the resource cushion during the fall is attributed to hunting pressures on the East Front. The Grizzly Bear Studies on the East Front (Aune et al., In Prep.) indicate that the grizzly bear population has remained stable or perhaps has slightly increased despite this level of hunter disturbance and under even higher levels of exploratory drilling for oil/gas than will occur under field development for the Blackleaf Unit. The analysis presented in the previous section of this opinion on mortality risks demonstrates that the level of mortality occurring from all causes under the on-going level and kinds of human activities falls within theoretical acceptable limits for the grizzly bear population in the analysis area. Thus, the Service concludes that the additive impacts of field development of the Blackleaf production units, along with other past and on-going activities, are not likely to affect the numbers, reproduction or distribution of grizzly bears at a level that is likely to jeopardize the species.

<u>Gray Wolf</u>: The Rocky Mountain Front is considered excellent wolf habitat due to: (1) its abundant and diverse prey base, (2) its wilderness status or otherwise remote areas, and (3) its relatively low human use and access. At present, available data do not indicate sustained pack activity or a viable wolf population in the area. However, sporadic wolf observations indicate possible use, at least by transient individuals. There have been 115 wolf occurrence reports recorded on the Rocky Mountain Front (Glacier National Park/East of the Continental Divide, Blackfeet Indian Reservation, Bureau of Land Management/Great Falls Resource Area, and Lewis and Clark National Forest) during the period 1978-1989 (U.S. Fish and Wildlife Service Files), 69% of these have occurred within the last five years (1985-1989). The potential for a breeding pair to establish residence and pack formation to develop through natural recruitment appears imminent. Two key factors for successful wolf recovery in the area are: (1) maintenance or improvement of a healthy prey base and (2) preventing illegal mortalities.

Maintenance or Improvement of a Healthy Prey Base

Elk and mule deer are the two major prey species for wolves on the East Rocky Mountain Front (Peek and Vales, 1989). Oil and gas activities that result in population declines of these species would have negative effects on wolf recovery and management on the East Rocky Mountain Front. Approximately

180 elk winter in and adjacent to the Blackleaf EIS study area (BLM, PDEIS). Winter counts of mule deer in 1986 on the Blackleaf-Teton and Dupuyer Creek winter ranges were 450 and 250 animals, respectively (BLM, PDEIS). Figures 3.9 and 3.10 (Appendix G) show the mule deer and elk winter ranges in the EIS analysis area.

Elk begin their migration from summer ranges about mid-November and concentrate in the Middle and South Forks of Dupuyer Creek, Ping's Coulee, and Cow Creek areas. In early December the herd splits, some moving north toward Birch Creek and some south into the Antelope Butte area, arriving about January 1. The elk begin their spring migration back to summer ranges in mid-May, some elk calving occurs west of Antelope Butte in late May (Figure 3.10, Appendix G). Thus, the critical period for elk in the project area is January through May. Mule Deer begin their migration to the area about November 1.

Geist (1971) discusses disturbance factors as they relate to wild ungulates and states "if the disturbance is common and localized in time and space, the animal soon learns to avoid it. What is known of the effects of disturbance is disquieting. Excitation is costly because it elevates metabolism (Graham, in Baxter, 1962), and raises the energy cost of living, thus competing directly with energy otherwise available for reproduction and growth. Another serious consequence of persistent disturbance is voluntary withdrawal from available habitat and the confinement of the population to a smaller and less favorable area. Habitat left unused is wasted. Moreover, once suitable habitat has been lost by the animals withdrawal, it may be quite difficult for certain species to return, i.e., bighorn sheep (Geist 1967), elk (McCullough 1969), or pronghorn antelope (Binarsen 1948)."

Our no jeopardy conclusion for the wolf is based in part on the following:

1. Adherence to a July 15 to December 15 timing window within which a 3-1/2 month operating period would be selected for road constructions, drilling and heavy maintenance activities.

   An operating period between July 15 and December 15 for field development greatly minimizes displacement of deer and elk from their winter ranges and avoids disturbance during the calving and fawning periods.

2. One central gas processing plant allowing for remote monitoring of well heads and closing access roads to wells to motorized use by the public.

   As discussed under the grizzly bear section of this opinion, remote well head monitoring, once wells are brought into production, will greatly reduce the need for daily/weekly visits to each wellsite, thereby minimizing disturbance to the prey species of the wolf. This is particularly important during the winter and spring calving/fawning periods.

   As shown in Table 2 for the grizzly bear, reductions in habitat effectiveness during the production phase are minimal due to the central gas plant, remote monitoring and road closures. Therefore if seasonal operating periods and road restrictions are adhered to, remote monitoring required and enforced, and no more than two wells drilled concurrently,

impacts to the wolves' prey base from displacement during exploration and production is not expected, in turn, to affect the numbers, reproduction or distribution of the wolf at a level that would jeopardize the continued existence of the species.

Preventing Illegal Mortality

In reviewing the literature on population dynamics of wolves, Keith (1982) compared reported exploitation rates with resulting numerical trends from 13 different wolf populations. He reported that wolf reproduction and/or pup survival can apparently offset rates of exploitation up to 30%. However, if human-caused mortality rates are greater than 30%, wolf numbers may decline.

There is little evidence that human activity other than direct killing has caused wolf mortality. While wolves appear most sensitive to human disturbance near den sites, there is little evidence to suggest such disturbance will cause reproductive failure. In view of this information, the Service believes that displacement/disturbance of wolves created by field development activities, accept for those that may impact whelping dens and initial rendezvous sites, will have little or no demographic effects.

The Service believes the single most important factor to successful wolf recovery is to prevent illegal human-caused mortality. This can best be provided by promoting public acceptance of the animal and providing adequate security. Our no jeopardy conclusion is based in part on the following:

1. access roads to wellsites will be obliterated and revegetated in the case of dry wells, and in the case of producible wells, the access roads will be closed to motorized use by the public;

2. a no firearms policy for industry employees while on duty; and

3. presently there are no known packs in the Blackleaf EIS analysis area, and hence no known den sites or rendezvous sites.

INCIDENTAL TAKE

Section 9 of the Endangered Species Act, as amended, prohibits any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species without a special exemption. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered taking within the bounds of the Act provided that such taking is in compliance with the incidental take statement.

The Service does not anticipate that field development on the Blackleaf Production Area will result in any incidental take of grizzly bears and gray wolves. Accordingly, no incidental take is authorized. Should any take occur, the Forest Service must reinitiate formal consultation with the Service and provide the circumstances surrounding the take.

Our conclusion that no incidental take is expected is based on the following:

As defined by the Act, the term "take" means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct" 10 U.S.C. 1532(19). Further, "harm" is defined to include "an act....[that] may include significant habitat modification or degradation where it actually kills or injuries wildlife by significantly impairing essential behavior patterns including breeding, feeding, or sheltering" (50 CFR 17.3).

"Taking" therefore is not expected to result from the proposed actions due to:

1. a spring seasonal restriction on construction and drilling during the critical spring period (grizzly bear spring foraging and elk/deer calving and fawning) and an operation window that minimizes overlap of construction and drilling during the fall bear use period and elk/deer use of winter ranges;

2. no direct or indirect impacts to denning bears or wolves;

3. firearms are prohibited;

4. adequate habitat that bears can displace to that is absent of other motorized activities is available;

5. no construction camps will be permitted on site; and

6. roads to wellsites will be closed to public traffic.

The illegal killing of grizzly bears and gray wolves, be it through poaching or "mistaken identity", is a violation of both State and Federal law and will be prosecuted. All other taking of grizzly bears must be done in compliance with the 50 CFR S17.40(b) and applicable State laws.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Endangered Species Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. The term conservation recommendations has been defined as suggestions of the Service regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.14(j)).

The Service provides the following conservation recommendations that would further minimize the adverse impacts of field development and help enhance the survival and recovery of the species:

1. Once a well has been brought into production, daily or weekly visitation to the wellsite should be restricted to a six month period or less after which remote monitoring should be the primary means of monitoring the wellhead.

2. To increase habitat effectiveness, particularly in the fall, the BLM should pursue opportunities to close additional roads or trails to motorized use.

3. Should wolf packs establish themselves on the East Front, the BLM when processing APDs should insure that field development activities do not adversely affect dens and initial rendezvous sites. Informal consultation should be initiated with the Service to ensure that current information is being considered.

CONCLUSION

This concludes formal consultation on this action. Reinitiation of formal consultation is required if the amount or extent of incidental take is exceeded, if new information reveals effects of the action that may impact listed species or critical habitat in a manner or to an extent not considered in this opinion, if the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion, or if a new species is listed or critical habitat designated that may be affected by the action.

Your cooperation and assistance in meeting our joint responsibilities under the Endangered Species Act are appreciated.

cc: ARD, FWE-60120, FWS, RO, Denver, CO
OES, FWS, Washington, DC
Area Manager, BLM, Great Falls, MT
Forest Supervisor, Lewis & Clark NF, Great Falls, MT
Director, Montana Dept. of Fish, Wildlife & Parks, Helena, MT
Grizzly Bear Recovery Coordinator, FWS, Missoula, MT

DRHARMS/clh

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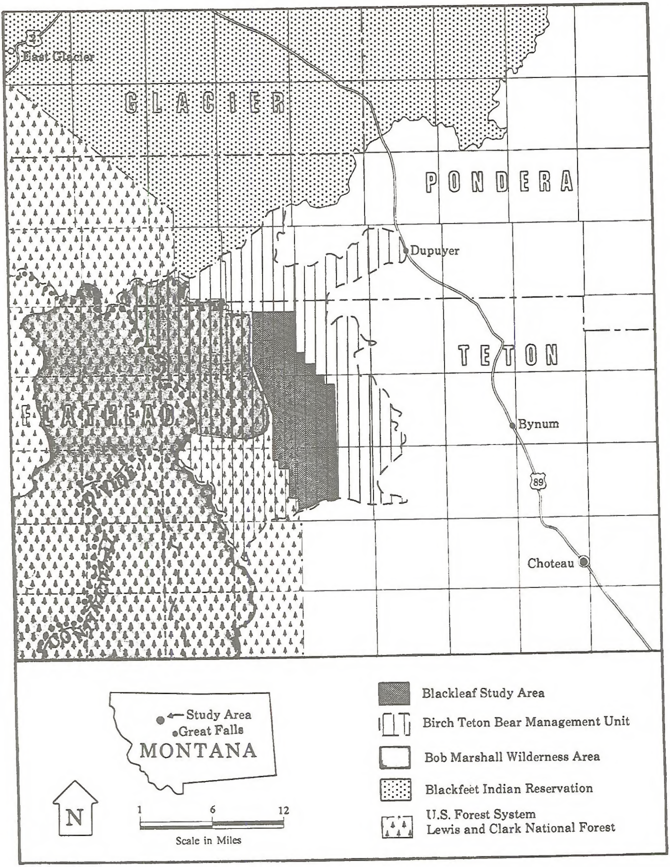
APPENDIX A

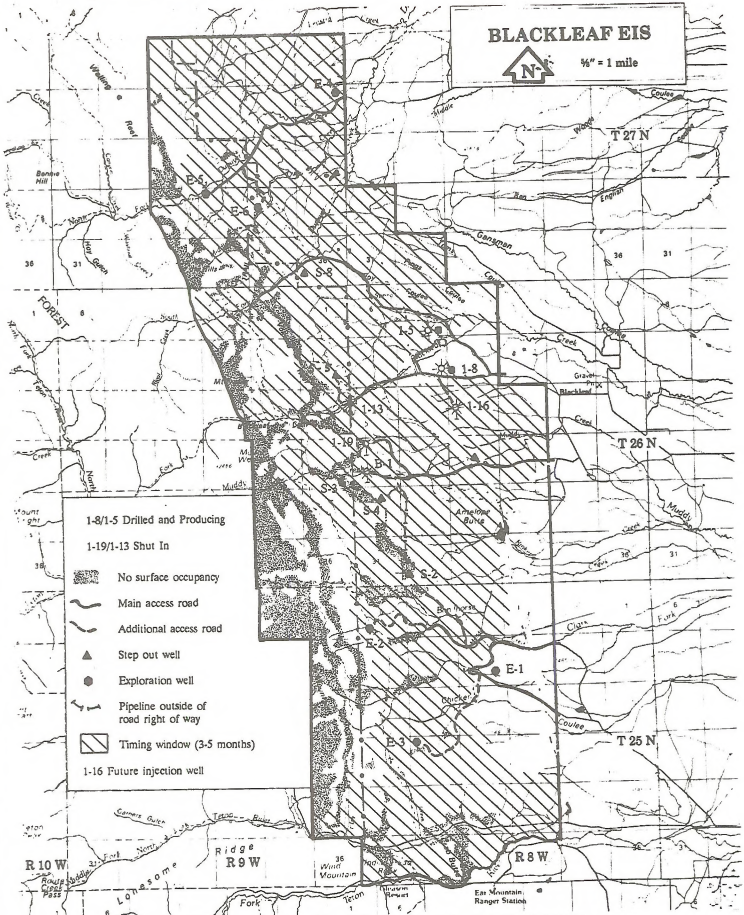
Figure 1.1 Location Map of Blackleaf EIS Study Area and Birch Teton Bear Management Unit



Source: BLM, 1989. Draft Blackleaf Environmental Impact Statement.

APPENDIX B

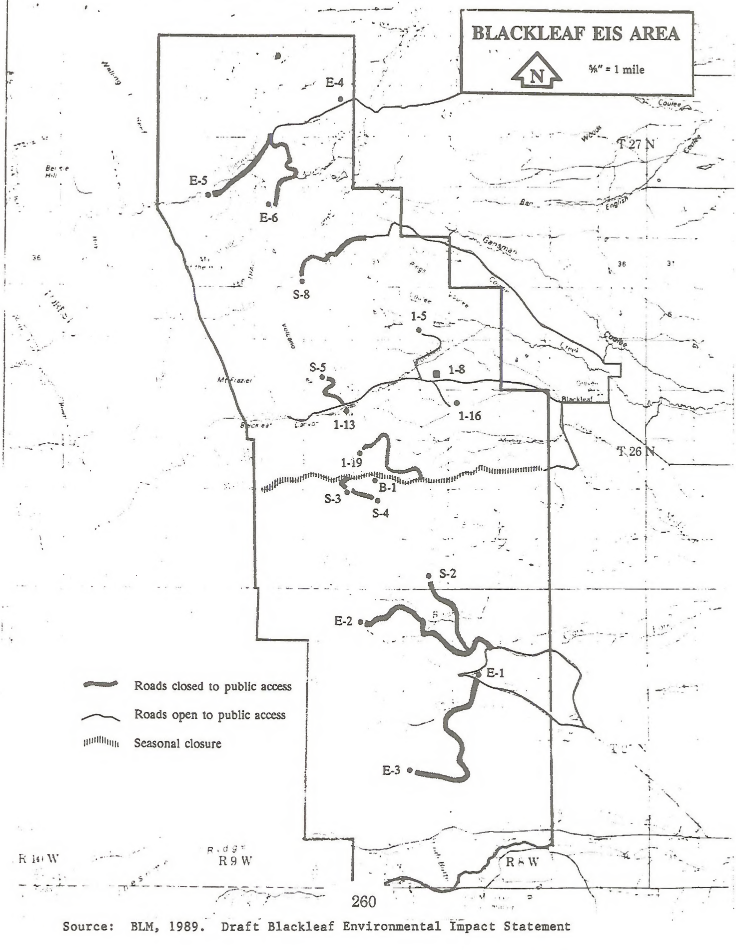
Figure 2.9 Alternative Four.



Source: BLM, 1989. Draft Blackleaf Environmental Impact Statement.

APPENDIX C

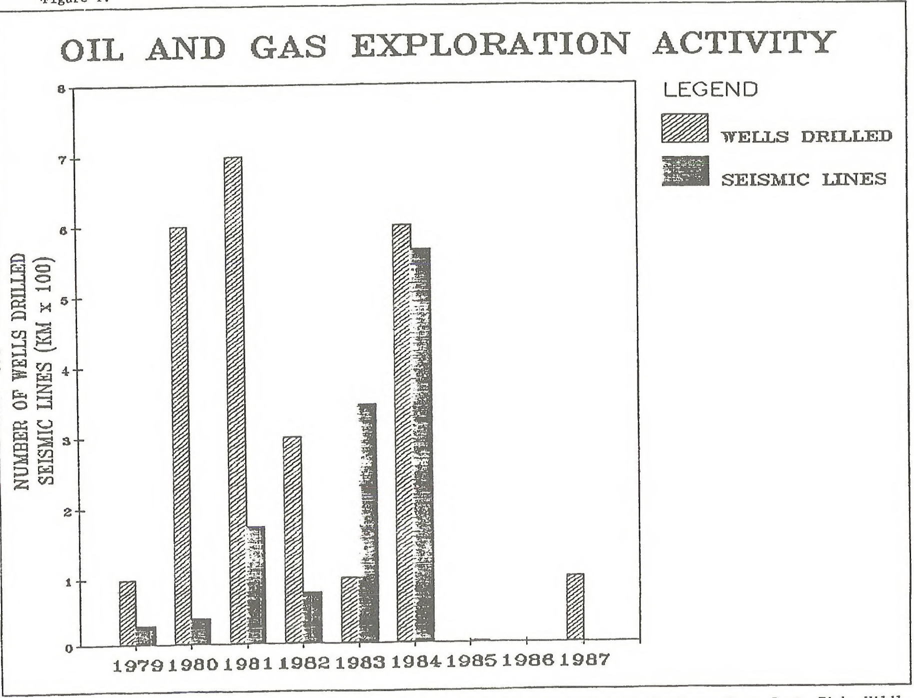
Figure 4.4 Access Routes in the Blackleaf EIS Area.



Source: BLM, 1989. Draft Blackleaf Environmental Impact Statement

APPENDIX D

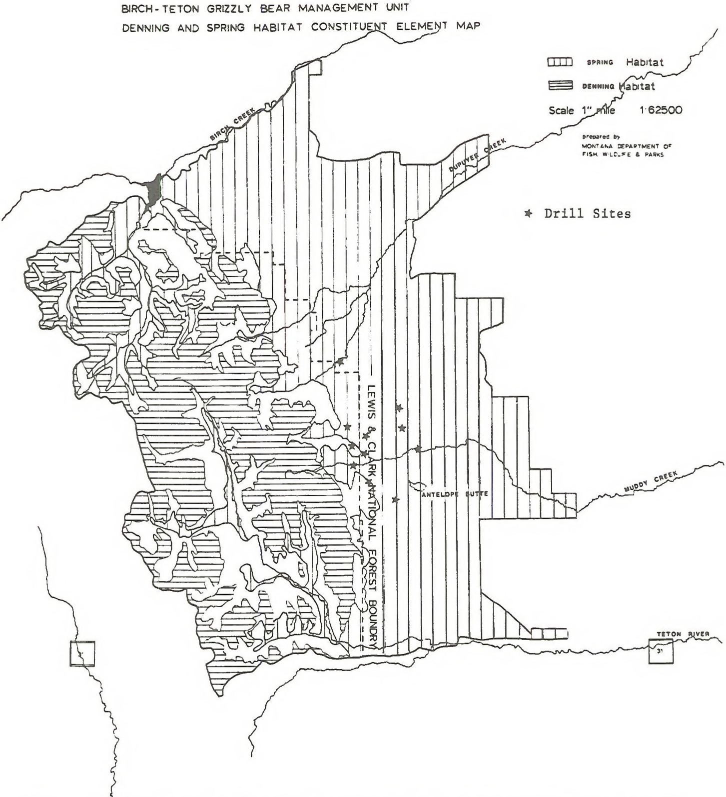
Figure 1.



Source: Aune, K. 1989. Preliminary draft Final Report, East Front Grizzly Studies. Mont. Dept. Fish, Wildl. and Parks, Helena, Montana (In Preparation).

APPENDIX E

FIGURE 2. CONSTITUENT ELEMENT MAP, 1986



Source: Management Guidelines for Selected Species - Rocky Mountain Front Studies.

APPENDIX F

Table C-7

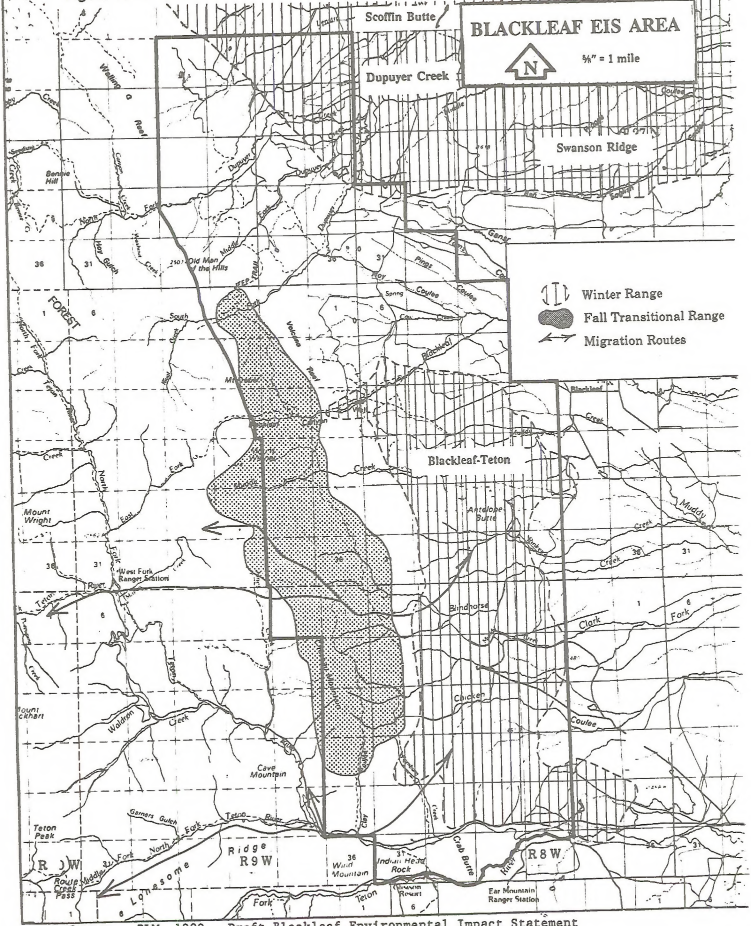
Mortality Risk Index (MRI) by season for the existing situation (base) and each Alternative and increase in MRI when at full production.

	SPRING		SUMMER		FALL	
ALTERNATIVE	MRI	INCREASE FROM BASE	MRI	INCREASE FROM BASE	MRI	INCREASE FROM BASE
EXISTING SITUATION (BASE)	0.087		0.115		0.324	
1	0.092	0.005	0.115	same	0.325	0.001
3	0.094	0.007	0.116	0.001	0.326	0.002
4	0.098	0.011	0.117	0.002	0.327	0.003
2	0.103	0.016	0.121	0.006	0.332	0.008

Source: BLM Biological Assessment for Endangered and Threatened Species. Preliminary Draft Environmental Impact Statement.

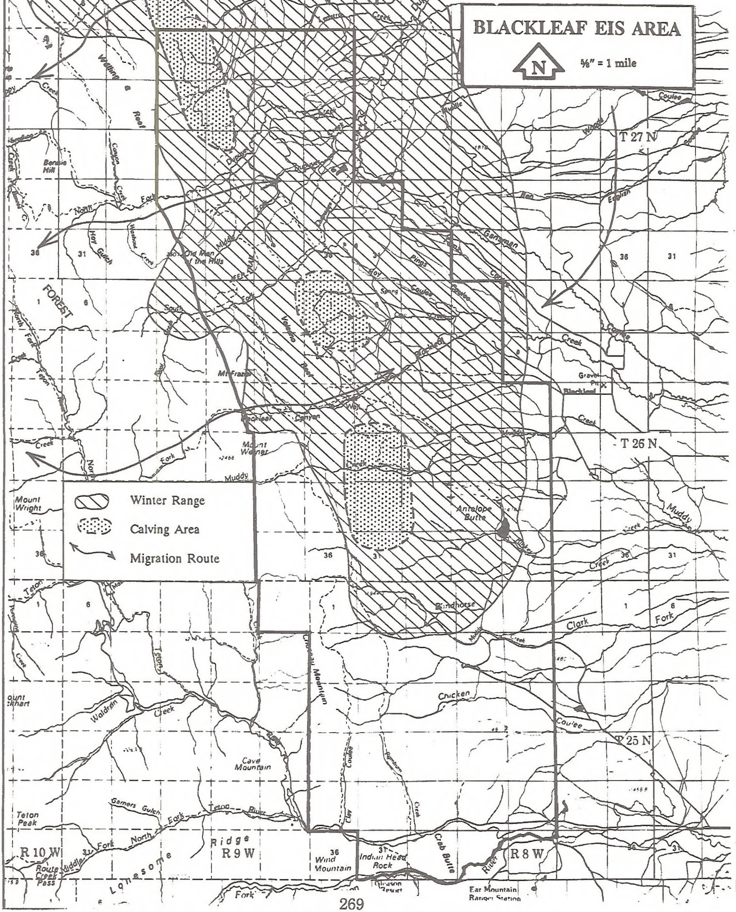
APPENDIX G

Figure 3.9 Mule Deer Habitat in the Blackleaf EIS Area.



Source: BLM, 1989. Draft Blackleaf Environmental Impact Statement

Figure 3.10 Elk Habitat in the Blackleaf EIS Area.



Source: BLM, 1989. Draft Blackleaf Environmental Impact Statement.

APPENDIX M

SURFACE GEOLOGY

Ktm TWO MEDICINE FORMATION (UPPER CRETACEOUS)

Sedimentary facies - Nonmarine mudstones with some sandstone, north of Augusta. Upper and middle parts consist mostly of gray-green to gray mudstone with reddish-gray, red-brown, and purple interbeds. Interbeds of fine to medium grained sandstone in upper part of sandstone beds. Locally contain abundant vertebrate bones and pelecypods in upper 150 meter (m). Thin conglomerate about 245 m below the top occurs north of Birch Creek (Cobban, 1955). Contains many thick beds of gray to greenish-gray sandstone, interbedded with gray-green, olive-drab, and gray mudstone in lower part of formation (about 170 m). Locally as much as 50 m thick, poorly indurated, fine to medium-grained, massive to thin-bedded, and in part crossbedded sandstone beds, a conglomerate is included in the sandstone (Mudge, 1972). Carbonaceous shale, as much as 1.5 m thick, widespread near base of formation. Locally abundant petrified wood in a sandstone unit above the carbonaceous shale, erodes into badland topography similar to the St. Mary River Formation. The Two Medicine is about 670 m thick. Widespread in eastern part of mapped area and present in the North Fork Sun River area.

Km MARIAS RIVER SHALE (UPPER CRETACEOUS)

Mainly dark-gray, marine mudstone, ranges from 365 to 395 m thick. Divided into four members by Cobban, Erdmann, Lemke, and Maughan (1959b, 1976), in descending order: Kevin, Ferdig, Cone, and Floweree.

The Kevin is dark-gray, calcareous mudstone with some thin, very fine grained sandstone in upper part. Characteristically contains many thin, micaceous bentonite beds and zones of calcareous and ferruginous limestone concretions. Bentonite beds thicker and far more numerous in southern outcrops. Pelecypods and ammonites common. The Kevin Member ranges from about 226 m thick in the east to as much as 326 m in the west (Mudge, 1972).

The eastern facies of the Ferdig Member contains gray, noncalcareous mudstone with many very thin, iron-stained sandstone beds, concretions of yellow-weathering limestone and red-weathering ferruginous dolostone, and some very thin bentonite beds, about 50 m thick. The western facies of the Ferdig, exposed in the North and South Forks of the Sun River, is about 150 m thick, and resembles the Cardium Formation of southern Alberta, Canada (Mudge, 1972). Contains nodular sandstone, sandy shale, and even-bedded sandstone in the middle and upper parts of the western facies; thick-bedded, light-gray sandstone in upper parts. Organic burrows and trails common. The lower part is like that exposed in the eastern facies.

The Cone Member contains abundant, very thin, medium-gray, calcareous siltstone and crystalline limestone beds in the upper part and dark-gray noncalcareous fissile shale with some limestone concretions in the lower part (Cobban, Erdmann, Lemke, and Maughan, 1976); contains several bentonite beds throughout. The upper beds commonly have petroliferous odor on a freshly broken surface. Contains a characteristic fauna which includes Mytiloides labiatus (Cobban, Erdmann, Lemke, and Maughan, 1976). Ranges from 15 to 30 m thick.

The Floweree Member is noncalcareous, dark-gray, nonfossiliferous shale (Cobban, Erdmann, Lemke, Maughan, 1976; Mudge, 1972). Locally contains basal siltstone with chert-pebble conglomerate. The shale has metallic luster and yellowish-brown stains on bedding and fracture planes (Mudge, 1972). Ranges from 9 to 12 m thick.

Kb BLACKLEAF FORMATION (LOWER CRETACEOUS)

Gray, marine mudstone and interbedded sandstone. Divided into three members by Cobban, Erdmann, Lemke, and Maughan (1959b, 1976), in descending order: Vaughan, Taft Hill, and Flood. The formation ranges from about 200 m thick in southern outcrop to about 490 m in the west and about 260 m in the north.

The nonmarine Vaughan Member consists of alternating gray to olive-drab mudstones and bentonitic mudstone with many thin interbeds of light-gray, locally crossbedded sandstone. Contains less sandstone to the north and lower beds are laterally equivalent to upper part of the marine Taft Hill strata to the south. Locally, beds of conglomerate fill small channels at base of some sandstone units (Mudge, 1972). In the Sun River area, the upper part of member contains tuffaceous debris, one bed contains accretionary lapilli (Mudge, 1972). Member locally contains wood and leaf fragments and, in the vicinity

of Teton Pass, contains beds of coal and carbonaceous shale. Ranges from 90 m thick in the eastern outcrops to possibly 213 m in the north.

In the south, the marine Taft Hill Member consists of thinly bedded, gray, fossiliferous sandstone, locally crossbedded and ripple marked (Mudge, 1972), interbedded with dark-gray mudstone containing some very thin bentonite beds. These units grade northward into nonmarine lighologies of the Vaughan. The Taft Hill is as much as 183 m thick in west-central part of the area, thins to 0 m to the north and 58 m in the southeast outcrop.

The marine Flood Member in the south consists of two sandstone units with a distinctive intervening shale unit. Lower sandstone absent to the north where upper sandstone unit is thicker and shale unit thinner, as compared to southern exposures. Gray, thinly crossbedded, very fine grained, finely micaceous and moderately well sorted sandstones (Mudge, 1972); commonly weather grayish brown. Locally large sandstone nodules in lower part. The shale unit, transitional with upper sandstone unit, is distinct, very dark gray fissile shale with a metallic luster on bedding surfaces. Thin sandstone lentils and nodules of limestone and claystone common, locally phosphatic nodules present. Organic trails and burrows abundant in transition zone. The Flood ranges from 45 m thick in eastern outcrops of 165 m in western. About 40 m thick in the north part of mapped area (Rice and Cobban, 1977).

Kk KOOTENAI FORMATION (LOWER CRETACEOUS)

Nonmarine, gray-green and maroon mudstone with numerous lenticular, poorly sorted, greenish-gray sandstone beds, locally crossbedded and contain lenticular basal conglomerates (Mudge and Sheppard, 1968; Mudge, 1972). Brown to brownish-gray limestone with thin to thick lenses of coquina with pelecypods and gastropods is near top of formation. Brown, iron-stained limestone nodules common in mudstone beds. The Sunburst Sandstone Member of Rice and Cobban (1977) is at base of formation in the southern outcrops and absent to the north. The Sunburst consists of many thin beds of hard, noncalcareous, poorly sorted quartz sandstone with few scattered grains of chert and feldspar. The Kootenai ranges from 198 to more than 305 m thick.

Kjm LOWER CRETACEOUS MOUNT PABLO FORMATION AND JURASSIC MORRISON FORMATION AND ELLIS GROUP, UNDIVIDED

The Morrison Formation is not mapped separately and therefore is described below.

The most complete sections of the Morrison are in east-central and southern outcrop areas. Mainly grayish-green, tuffaceous siltstone with interbedded sandstone, limestone, and some cherty siderite in the eastern part of the Sun River Canyon area (Mudge, 1972). Maroon and tints of pinkish-gray beds common in the upper part. Cherty siderite occurs as lenses in the middle part, limestone occurs as beds or nodules in the lower part. The Morrison is about 61 m thick in the Sun River area (Mudge, 1972), about 82 m thick in the Wolf Creek area (Schmidt, 1972a). Mostly eroded prior to deposition of the Mounta Pablo Formation north of the Sun River area. In most places, the Morrison is less than 30 m thick.

Je ELLIS GROUP (UPPER AND MIDDLE JURASSIC)

Divided into three formations by Cobban (1945), in descending order. Swift, Rierdon, and Sawtooth. In the Wolf Creek area the Rierdon Formation is absent, the combined thickness of the Swift and Sawtooth Formations is about 65 m. The three formations have an aggregate thickness of about 87 m in the Sun River area, about 205 m thick west of that area, and more than 188 m in the northern part of mapped area (Mudge and Earhart, 1978).

The Upper and Middle Jurassic Swift Formation was divided into upper and lower unnamed members by Cobban (1945). Ranges from 30 to 36 m thick in the southeast to more than 60 m in the northwest. In the northeast, part of the upper member was eroded prior to sedimentation of the Cretaceous Mount Pablo Formation. The upper member is thin-bedded, gray to gray-brown, very fine to fine-grained sandstone. As much as 30 m thick in the Sun River area (Mudge, 1972), less than 3 m thick in the northeast outcrop. The lower member is dark-gray shale with some interbeds of sandstone. A thin bed of poorly indurated glauconitic sandstone with water-worn belemnites and locally chert pebbles, at base of the member except in the northern outcrops. The lower member averages about 15 m thick in the south and about 21 m thick in the north. The Swift unconformably overlies the Rierdon Formation.

The Middle Jurassic Rierdon Formation contains calcareous gray-brown siltstone and claystone in the upper part and calcareous, dark-gray, laminated shale and claystone in the lower part. Many thin beds of argillaceous limestone scattered throughout formation. Barite nodules, numerous pelecypods and some ammonites common. Phosphatic nodules common in the lower part of the northern exposures. About 44 m thick in the Sun River area, as much as 56 m thick to the north.

The Middle Jurassic Sawtooth Formation is divided into three unnamed members by Cobban (1945), the lower member is absent in the northern outcrop area. Ranges in thickness

from 15 to 69 m, thickening to the north. The upper siltstone member is a prominent unit, many thin beds of grayish-brown to yellowish-gray siltstone with a few thin beds of shale, increasingly sandy northward. Lenses of phosphatic pellets common in the western and northern outcrops. Pelecypods common and ammonites rare. Member 6-13 m thick in the south (Mudge, 1972), thickens northward to about 18 m (Imlay, 1962). The shale member is dark-gray shale with some siltstone, sandstone, and a few beds of limestone. Thickens northward from 5 m in the Sun River area to about 77 m near Mount Patrick Gass. Some beds locally pyritic. North of the Teton River contains black, phosphatic pellets and lies unconformably on Mississippian carbonate rocks. The lower sandstone member in the southern part of the area rests unconformably on Mississippian rocks. In most places, hard, fine-grained, and light-gray sandstone beds, conglomeratic in the basal part. Locally consists of two beds of sandstone separated by dark-gray shale. The conglomerate consists of pebbles and cobbles and locally boulders of Mississippian carbonate and chert (Mudge, 1972). The sandstone member ranges from 0-6 m thick, in most places 0.6-2 thick (Mudge, 1972).

Mm MADISON GROUP (UPPER AND LOWER MISSISSIPPIAN)

Divided into the Castle Reef Dolomite and the underlying Allan Mountain Limestone (Mudge, Sando, and Dutro, 1962), equivalent in age to the Mission Canyon and Lodgepole Limestones in Central Montana. The Madison ranges from about 275 m to 550 m thick, much of the variation in thickness is a result of pre-Jurassic erosion (Mudge, 1972).

The Upper and Lower Mississippian Castle Reef Dolomite, ranges from about 230 m thick in the eastern outcrops to about 305 m in the west, is divided into an upper member, the Sun River Member, and a lower unnamed member (Mudge, Sando, and Dutro, 1962). The Sun River Member, 76-137 m thick, consists mostly of thick beds of fine to medium-crystalline dolomite (Mudge, 1972), and is main hydrocarbon reservoir rock on the Sweetgrass Arch (Chamberlain, 1955). In many places oil residues common in cavities, pores, fractures, and on bedding planes in the upper part of the member. The lower member of the Castle Reef consists of thin to thickbeds of fine to coursely crystalline, light-gray dolomite, calcitic dolomite, and dolomitic limestone, dolomite content increases westward. Beds of coursely crystalline encrinites at various horizons in the Castle Reef, increasingly abundant to the north and west. Lenses and nodules of dark-gray chert common in lower and middle parts, light-gray chert nodules common in upper part. In places, sand-filled joints and bedding planes in upper part (Mudge, 1972). Corals and brachiopods common in the formation.

The Lower Mississippian Allan Mountain Limestone, ranges from about 165 to 200 m thick, contains three widespread unnamed members. The upper member is mainly gray, medium-to thick-bedded, fossiliferous limestone with some beds of dolomitic and magnesium limestone (Mudge, Sando, and Dutro, 1962). In places encrinite beds occur in middle and upper parts of member. Member ranges from 42 to 106 m thick. The middle member contains abundant, irregular-shaped lenses and nodules of very dark chert in sparsely fossiliferous, medium-bedded, dark-gray limestone and dolomitic limestone, ranges from 45 to 58 m thick. Chert is dispersed throughout member at 15-25 cm intervals. The lower member consists of very thinly bedded, dark-gray, argillaceous limestone and dolomitic limestone with dark-gray shale partings (Mudge, Sando, and Dutro, 1962). The lower part of lower member contains alternating beds of dark-gray to gray-brown limestone and very calcareous shale, locally potential hydrocarbon source rocks (Mudge, Rice, Earhart, and Claypool, 1978); ranges from 50 m to 67 m thick.

GLOSSARY

AIRSHED.

Class I Area. Any area which is designated for the most stringent degree of protection from future degradation of air quality. The Clean Air Act designates as mandatory Class I areas each national park over 6,000 acres and each national wilderness area over 5,000 acres.

Class II Area. Any area cleaner than federal air quality standards which is designated for a moderate degree of protection from future air quality degradation. Moderate increases in new pollution may be permitted in a Class II area.

Class III Area. Any area cleaner than federal air quality standards which is designated for a lesser degree of protection from future air quality degradation. Significant increases in new pollution may be permitted in Class III area.

ANTICLINE. An arched, inverted-trough configuration of folded and stratified rocks.

ALLOTMENT. An area of land where one or more livestock operators graze their livestock. Allotments generally consist of BLM lands but may also include state owned and private lands. An allotment may include one or more separate pastures. Livestock numbers and seasons of use are specified for each allotment.

ALLOTMENT MANAGEMENT PLAN (AMP). A written program of livestock grazing management, including supportive measures if required, designed to attain specific management goals in a grazing allotment.

AMBIENT AIR QUALITY STANDARDS. The permissible level of various pollutants in the atmosphere, as contrasted with emission standards which are the permissible levels of pollutants emitted by a given source.

ANIMAL UNIT MONTH (AUM). A standardized measurement of the amount of forage necessary for the complete sustenance of one animal for one month; also the measurement of the privilege of grazing one animal for one month.

BACKTHRUST. In general, a backwards movement or movement opposite the general direction of thrust movement. In the Blackleaf area, the general movement was from west to east; backthrusting from east to west.

BEAR MANAGEMENT UNIT (BMU). An analysis area delineated using criteria for provision of sufficient constituent elements and effective habitat to meet a subpopulation goal for adult female grizzlies, general fit of movement patterns observed for radio-collared grizzlies, and similarities in mountain orientation and topography as it influences forage richness, movements, and travel corridors.

CONFIRMATION WELL. The second producer in a new field, following the discovery well.

CRITICAL HABITAT. Any habitat, which if lost, would appreciably decrease the likelihood of the survival and recovery of a threatened or endangered species, or a distinct segment of its population. Critical habitat may represent any portion of the present habitat of a listed species and may include additional areas for reasonable population expansion. Critical habitat must be officially designated as such by the Fish and Wildlife Service or National Marine Fisheries Service.

CRUCIAL WILDLIFE HABITAT. Parts of the habitat necessary to sustain a wildlife population at critical periods of its life cycle. This is often a limiting factor on the population, such as breeding habitat, winter habitat, etc.

DRY HOLE. Any well that does not produce oil or gas in commercial quantities.

ENDANGERED OR THREATENED SPECIES. Determined for plants and animals by one or a combination of the following factors:

1. The present or threatened destruction, modification or curtailment of a species habitat or range.
2. Over-utilization of a species for commercial, sporting, scientific or educational purposes.
3. Disease or predation of the species.
4. The inadequacy of existing regulatory mechanisms.
5. Other natural or human caused factors affecting a species' continued existence.

EXPLORATION WELL. A well drilled in an area where no oil and gas production exists.

HELD BY EXISTING LEASES. The federal mineral estate currently leased for oil and gas.

HELD BY PRODUCTION. Leases are issued for generally a 10 year period; however, if the lease is producing, the terms of the lease are extended for the life of the production.

LEKS. A display or breeding area. In the case of sharp-tailed grouse this area is commonly called a dancing ground.

MOUNTAIN GOAT HABITAT (as per Joslin, 1986).

Occupied Yearlong — The heart of the habitat on the RMF. It is used yearlong and contains all known kidding — nursery areas and breeding areas.

Suitable Low Occupancy — Possesses all the environmental features of occupied habitat, but mountain goats have not been observed in these areas.

Transitional — By virtue of its juxtaposition with occupied and suitable areas, is used by goats primarily for travel, although some mineral licks do occur there.

Mineral Licks — Are more than simply a location where goats congregate to lick salt; they are important physiographic features which influence home range size and configuration of each goat using the area.

NORTHERN CONTINENTAL DIVIDE ECOSYSTEM. The large area in northern Montana which contains occupied grizzly bear habitat. The Rocky Mountain Front is part of this ecosystem.

NOTICE TO LESSEE-2B. Notice to Lessees and Operators of Federal and Indian Oil and Gas leases explaining the requirements for the handling, storing, or disposing of water produced from oil and gas wells on such leases.

NOXIOUS PLANT. According to the Federal Noxious Weed Act (PL 93-629), a weed that causes disease or has other adverse effects on man or his environment and therefore is detrimental to the agriculture and commerce of the United States and to the public health.

OUTSTANDING NATURAL AREA. Areas of outstanding splendor, natural wonder or scientific importance that merit special attention and care in management to ensure preservation in their natural condition. These areas are usually undisturbed, and may contain rare botanical, geological, or zoological values which are of interest for scientific research purposes. Access roads and public use facilities are normally located on the periphery of the area.

PRIMARY MULE DEER WINTER RANGE. Areas where a herd segment tends to concentrate during the winter, principally because it is a preferred habitat of the lowest available elevation that provides sufficient escape or thermal cover.

PRODUCTION UNIT. Several leases that are operated by one company.

RANGE CONDITION. The present state of vegetation of a range site in relation to the climax plant community of that site. It is an expression of the relative degree to which the kinds, proportions and amounts of plants in a plant community resemble that of the climax plant community for that site. Range condition is basically an ecological rating of the plant community. Air-dry weight is the unit of measure used in comparing the composition and production of the present plant community with that of the climax community.

RANGE DEVELOPMENT. A structure, excavation, treatment or development to rehabilitate, protect or improve public lands to advance range betterment. "Range Development" is synonymous with "Range Improvement."

RANGE FACILITIES. Any structure or excavation such as water sources, shade sources, etc. designed to facilitate range management.

RANGE SITE. A distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. A range site is the product of all the environmental factors responsible for its development. It is capable of supporting a native plant community typified by an association of species that differs from that of other range sites in the kind or proportion of species or in total production.

RANGE TREND. The direction of change in range condition and soil.

REVERSE FAULT BOUNDED HORST. A block of the earth's crust that has been uplifted along faults relative to the rocks on either side.

RIPARIAN. Zones along streams, ponds, or other water bodies characterized by plants and animals requiring substantial amounts of water. This includes floodplains, wetlands and all areas within approximately 100 feet of the normal high waterline.

ROADED NATURAL. A term used to classify recreation opportunities where human activities create an environment with moderate evidences of the sights and sounds of people. Such evidences may harmonize with the natural environment. Some facilities for motorized use are present.

SECONDARY MULE DEER WINTER RANGE. The remainder of the total winter range area that receives less use than the primary portion and which probably does not have as desirable habitat characteristics as the primary range.

SEMI-PRIMITIVE MOTORIZED. A term used to classify recreation opportunities where human activities create or maintain an area or site that is characterized by an essentially unmodified natural environment. Facilities are provided for challenging motorized experiences.

SEMI-PRIMITIVE NON-ROADED. A term used to classify recreation opportunities where human activities maintain an area in an essentially unmodified natural environment, without roads.

SPECIAL STIPULATIONS. Conditions or requirements attached to a lease or contract that apply in addition to standard stipulations (see below). They frequently provide additional protection of the environment from resource developments, e.,g., coal mining, oil and gas development. Special stipulations become effective by their specification in an RMP.

SPECIES OF SPECIAL INTEREST OR CONCERN. Species not yet listed as "endangered or threatened" but whose status is being reviewed because of their widely dispersed populations or their restricted ranges. A species whose population is particularly sensitive to external disturbance.

STABILIZED. To reduce accelerated erosion rates to natural geologic erosion rates.

STANDARD STIPULATIONS. Conditions or requirements attached to a lease or contract that detail specific actions to be taken or avoided during resource development, e.g., coal mining, oil and gas development. They usually provide basic protection of the environment.

STEP-OUT WELL. A well drilled adjacent to or near a proven well to ascertain the limits of the reservoir.

STRATA. Distinct, usually parallel beds of rock. An individual bed is a stratum.

STRATIFICATION. Natural layering or lamination characteristic of sediments and sedimentary rocks. (See Strata).

STRUCTURE. A formation of interest to drillers. For example, if a particular well is on the edge of a structure, the well bore has penetrated the structure near its periphery.

SYNCLINE. A down warped, trough-shaped configuration of folded, stratified rocks; the reverse of an anticline.

THREATENED SPECIES. A species that the Secretary of Interior has determined to be likely to become endangered within the foreseeable future throughout all or most of its range. See also "Endangered or Threatened Species."

TRANSITIONAL MULE DEER RANGE. These ranges can be the same as summer range for many deer that summer east of the Continental Divide. Animals which summer west of the Continental Divide appear to move to

transition areas east of the Divide with the first major fall storms. The major use of transition ranges is during October — December when they apparently provide a measure of security during hunting season. Spring movement (May — June) routes pass through the transition areas indicating that these areas may serve as fawning sites for some does.

THRUST FAULT. A fault resulting from compression in which older rocks are generally thrust over younger rocks.

THRUST SHEET. The geologic formations above the plane of the thrust fault.

TRANSITION RANGE. Range that is suitable for use of a nonenduring or temporary nature over a period of time.

TRAP. Layers of buried rock strata that are arranged so that petroleum accumulates in them.

UNNECESSARY OR UNDUE DEGRADATION. Surface disturbance greater than what would normally result when an activity is being accomplished by a prudent operator in usual, customary, and proficient operations of similar character and taking into consideration the effects of operations on other resources and land uses, including those resources and uses outside the area of operations.

VALID EXISTING RIGHTS. Legal interests that attach to a land or mineral estate that cannot be divested from the estate until that interest expires or is relinquished.

VISUAL ABSORPTION CAPABILITY. A measurement of the landscapes potential to accept alterations without significant loss of natural landscape character.

VISUAL CONDITION RATING. Existing visual condition is the present state of visual alteration which is measured in degrees of deviation from the natural appearing landscape.

VISUAL QUALITY OBJECTIVES. A desired level of excellence based on physical and sociological characteristics of an area. Refers to the degree of acceptable alteration of the characteristic landscape.

Preservation — A VQO that provides for ecological changes only.

Retention — A VQO that in general means mans activities are not evident to the casual visitor.

Partial Retention — A VQO that in general means mans activities may be evident but must remain subordinate to the characteristic landscape.

Modification — A VQO meaning mans activity may dominate the characteristic landscape, but must, at the same time, use naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in foreground or middle ground.

Maximum Modification — A VQO meaning mans activities may dominate the characteristic landscape, but should appear as a natural occurrence when viewed as background.

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